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COVER: The remarkable "Seaweed" gold specimen, now housed in the Smithsonian, is just one of the superb golds that will be on display at the Tucson Gem & Mineral Society Show, Feb. 12-15, 2004. (Photo courtesy Harold and Erica Van Pelt)

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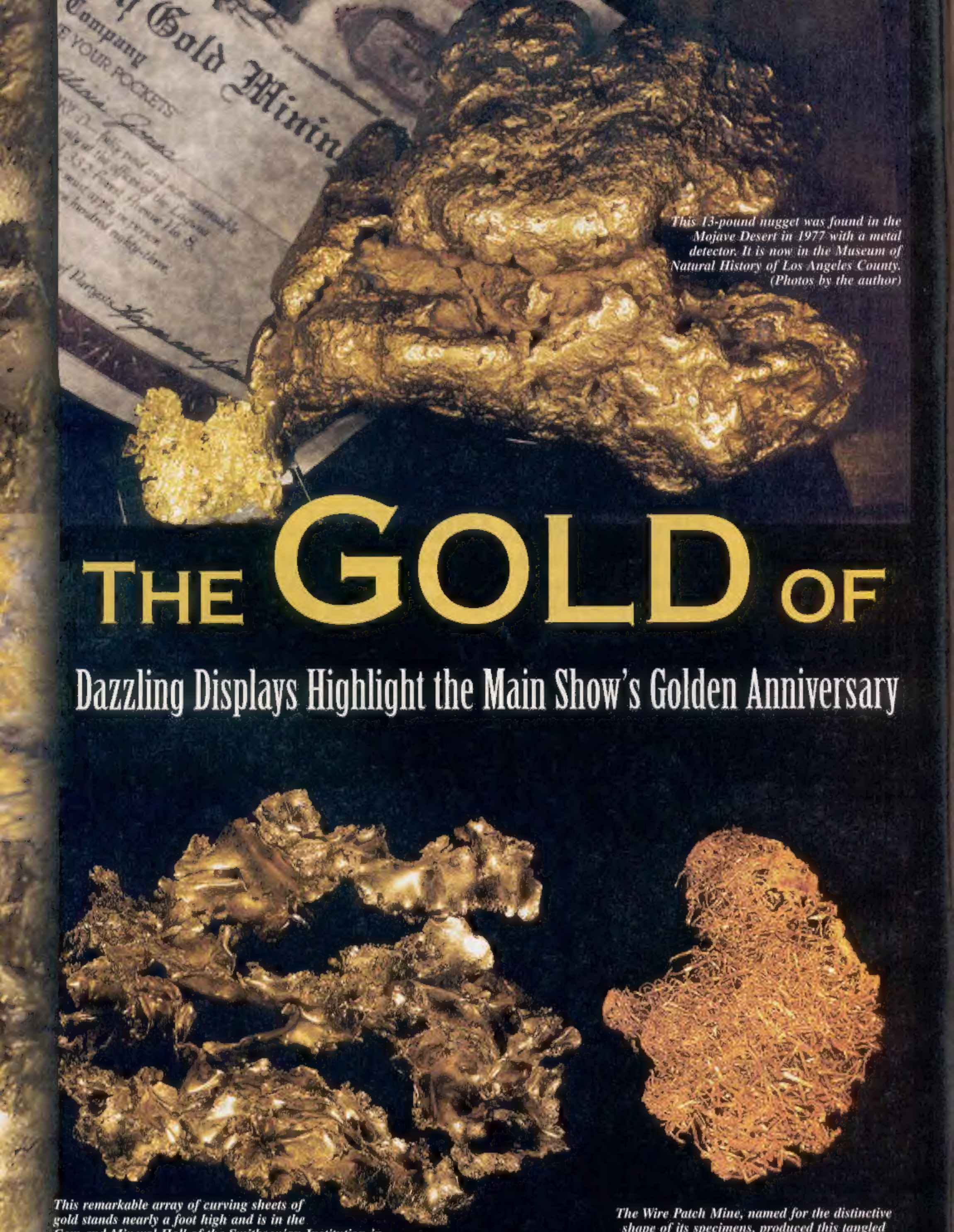


This 13-pound nugget was found in the Mojave Desert in 1977 with a metal detector. It is now in the Museum of Natural History of Los Angeles County. (Photos by the author)

THE GOLD OF

Dazzling Displays Highlight the Main Show's Golden Anniversary

This remarkable array of curving sheets of gold stands nearly a foot high and is in the Gem and Mineral Hall of the Smithsonian Institution in Washington, D.C. Its shape earned it the name "Seaweed."

The Wire Patch Mine, named for the distinctive shape of its specimens, produced this tangled gold, now in the Harvard collection.

SHOP TALK

by William A. Kappele

Eggs and Pasta

Art Kusas' daughter Joy e-mailed me to tell me that her father was interested in making gemstone eggs and to ask if I knew of anyplace to get information on making them. I sent her the dates of some back-issue articles on the subject, and it looks like that started an egg factory. Art got the articles and got busy. (By the way, kudos to the *Rock & Gem* staff for helping him with those back issues. Art says that they were very helpful in the process.)

When we first corresponded, Art had made eight eggs and had about five more in various stages of completion. By now, he probably has had to build an addition on the house to hold them. Also unusual is that his first egg was aluminum and bronze. This is understandable when you know that Art was a machinist by trade. His first stone egg took about 10 hours to complete, and he says he is glad he doesn't have to depend on egg making for a living. (Well, that's why chickens are always clucking, Art.) His enthusiasm for stone eggs extends to collecting those made by others, too. To date, his collection numbers 283. Art's wife has set 300 as the limit, but he says that she had said the same thing at 100 and 200, so maybe that addition to the house isn't so far-fetched.

Art's eggs are collected, too. One of his creations is in a monastery at Mount Athos in Greece. Congratulations, Art.

In the picture are, from left to right, Art's first egg (aluminum and bronze), two eggs of Montana agate, one of graveyard point plume, one of cycad, and one of Owyhee jasper. If any of you would like to give egg making a try, those two articles are in the September 1982 and the January 1998 issues of *Rock & Gem*. For pricing and availability, call (805) 644-3824 extension 10.

I called this column "Eggs and Pasta." We've seen the eggs, now let's find out about the pasta.

It is probably no secret anymore that I am one who loves to rescue old machinery, build my own, and find uses for machines for which they were not designed. So when I heard from Julius Fedor of Campbell, Ohio, about his unique use for a pasta machine, I had to report it to you.

Julius writes that he bought a pasta machine at a garage sale and turned it into a useful lapidary tool for rolling wire. Of course, there are lots of rolling mills on the market that he could have bought, but he is getting the job done and probably has enough money left over for a new Lexus (or at least a couple of cheeseburgers).

His machine has six positions for making pasta, so Julius got hold of some #12 and #14 Romex wiring. That's the stuff that your house is wired with. After stripping off the insulation, he ran it through his machine and flattened it a little. Next, he moved the machine a notch and tried again. This time it came out about ¾ inch wide. Julius plans to try some inlay work using his Romex copper rather than silver, although he feels that the pasta machine will roll silver, too. So, all of you would-be metal rollers see if you can sneak mama's pasta machine to your shop and give it a try. If it works, you can celebrate your finding a new tool by cooking her a nice pasta dinner. (Wash the machine first.)

Please feel free to contact me if you have a suggestion or comment about this or any of my Shop Talk columns. My e-mail is quappelle@cox.net, or write to me at 25231 Pericia Dr., Mission Viejo, CA 92691.

THE FRUGAL COLLECTOR

CALCITE

This Ubiquitous Mineral Has Something for Everyone

by Bob Jones

Have you ever wondered why important people or stage performers are said to be "in the limelight"? The term limelight comes directly from the mineral calcite. When calcite is strongly heated, it converts to lime, or calcium oxide. And that, in turn, will burn very brightly. So before electric lights, the glow of burning lime was used to light up a stage!

And while quartz may be the most common and most popular mineral on Earth, calcite has to be a close second as far as collectors are concerned. Its variety of crystal forms, great abundance, and attractiveness, not to mention its lapidary and decorative uses, certainly put calcite on a par with quartz as an important mineral. Found in just about every type of environment and in more than 300 different crystal forms, calcite has to be the single most collectible mineral as far as the Frugal Collector is concerned.

You may think calcite is found only as colorless or white crystals. Not so! It can be yellow, red, green, violet, brown, black, and almost every tint or shade in between. All these colors are due to the fact that it is easily invaded by some trace metal like iron or manganese or cobalt. And that does not include color due to included crystals of some other mineral. Minerals like malachite or cuprite often get included in it as it grows.

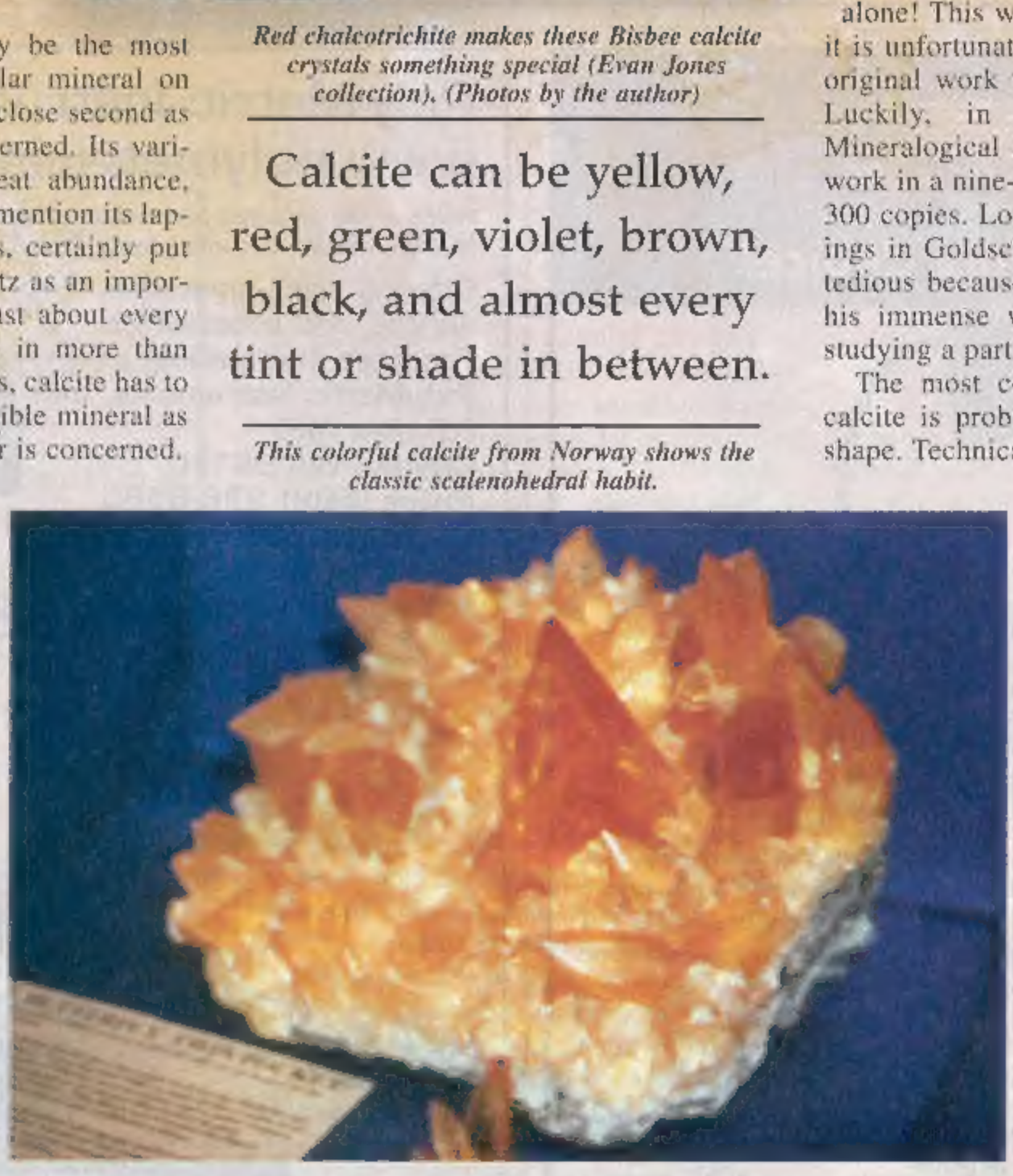
Calcite is so varied in its crystal forms that there are collectors who devote their entire collecting efforts to it. One dedicated crystallographer in Germany, Victor Goldschmidt, actually attempted to create line drawings of all the known minerals from virtually every known source of minerals in the late 1800s. In 1913, he succeeded in publishing his *Atlas der Krystallformen*, which holds more than 2,500 different line drawings for calcite alone! This was a remarkable feat, and it is unfortunate that more copies of his original work are not readily available. Luckily, in 1986, the Rochester Mineralogical Symposium reprinted his work in a nine-volume limited edition of 300 copies. Looking at the calcite drawings in Goldschmidt's book gets almost tedious because there are so many. Yet, his immense work is invaluable when studying a particular mineral crystal.

The most common crystal form for calcite is probably the pointy dogtooth shape. Technically, this is the scalenohedron form and is usually considered to be a low-temperature form of the mineral. Another common crystal shape is based on the rhombohedron, a form that looks like a slanted box. In fact, some of the Goldschmidt images outline a scaleohedron calcite crystal with the image of a rhombic form seemingly suspended within it. This gives the viewer a good idea of the direct relationship of the two seemingly different forms.

continued on next page

Red chalcotrichite makes these Bisbee calcite crystals something special (Evan Jones collection). (Photos by the author)

Calcite can be yellow, red, green, violet, brown, black, and almost every tint or shade in between.



This colorful calcite from Norway shows the classic scalenohedral habit.

Calcite *from page 20*

The richly colored calcites from Elmwood, Tennessee, make superb faceted display gems (Commercial Minerals Co.).

A trace of cobalt gives ordinary calcite from Zaire a wonderful pink hue (Halpern collection).

Yet another common crystal form for calcite has been given the name "poker chip" for obvious reasons. These are particularly interesting because they are often zoned, with a dark interior and outer surfaces that are white, so the crystal looks like a calcite sandwich. These flattened crystals often have a considerable number of modifying faces around the edges and are most interesting as a result.

Still another form has been described as "nailhead," because the crystal is a single vertical scalenohedral shaft topped by a more or less rhombic crystal that resembles the head of a nail.

So where do you look for calcite? You are lucky if you live in the Midwest. After all, that region is covered by vast layers of limestone, the rock made up largely of calcite. As it rains, water droplets pick up traces of carbon dioxide forming a weak carbonic acid, which eats away at the limestone. The now slightly acidic water trickles down through joints in the limestone, opening the cracks wider and even creating small cavities or, in some cases, large caves. This sets the stage for calcite crystal growth under the right conditions. Whenever the layers of limestone or its accompanying shale are breached during road building, quarrying, and even home building, there is always a chance crystals will appear.

Choice twinned calcites like this one from Egremont, England, are classics and are rarely seen for sale now.

Poker chip calcites are really highly modified hexagonal crystals. These are from Charcas, Mexico.

For example, along state Highway 61 in Lewis County, Missouri, road building exposed part of the Lower Warsaw rock formation. This is the zone from which superb quartz geodes have been dug for decades in the famous Keokuk, Iowa, and St. Francisville, Missouri, regions. (The term geode means "Earth shape" because, like the Earth, they are oblate spheroids.) This particular road cut struck geodes less than a year ago! And what would quartz geodes be if they did not have superb calcite crystals nested inside? These crystals add a measure of quality to the geode.

Midwesterners are particularly fortunate because there are a number of areas with geode potential. Every road cut that blasts into the Mississippian-age dolomitic mudstone formation called the Lower Warsaw has the potential to yield geodes. The Lower Warsaw formation gets its name from the town of Warsaw, Iowa. It outcrops along both banks of the Mississippi River from Warsaw north through Keokuk and Hamilton to Dallas City. This is a marine sedimentary rock with the right conditions for the formation of geodes. That par-

ticular limestone is rich in quartz, so geodes can form and often fill with superb calcite crystals. In fact, the geodes seem to have started out as calcite masses that formed as concretions. These, in turn, are slowly enclosed by chalcedony, which forms an outer shell. Given time, the calcite mass is etched away, leaving a cavity. Later, mineral-rich solutions line the cavity with quartz. Some of the original calcite may remain, and this forms calcite crystals. Later solutions may also cause the development of more calcites, as well as minor sulfides and other minerals.

While quartz is the most common mineral found in a Lower Warsaw geode, calcite is decidedly significant, as it tends to decorate the interior of the geode with lovely crystals. The calcite in these geodes takes on three crystal habits: rhombohedral, hexagonal, and scalenohedral prisms. The rhombohedral crystals can be almost equidimensional, so they show a pseudo-cubic habit. They can also form nailhead crystals.

The calcites in the geodes may be white, colorless, brown, or even pink due to included clay. Twins are not common, but have been found on occasion. Under the ultraviolet lamp, some of the calcites respond as either a pale orange color or a good white. Some phosphorescence occurs, as well.

Collectors in the Midwest can't wait for road construction to expose crystals. Instead, they get permission to go into working limestone quarries, where stone is mined for building and for use as cement and road fill. With vast amounts of limestone rock being moved, the inevitable calcite pockets are opened. Abandoned quarries tend to fill with water, but you can still find small pockets of crystals in the road rubble and still-accessible rock walls. Collectors have been known to lower themselves on ropes to get into exposed crystal pockets. Keep in mind that you have to have permission to get into working quarries, and your best bet is to be a member of a club, since clubs have a better chance of getting into an active quarry than a lone collector.

Some 30 years ago, a new area was opened in Missouri called the Viburnum Trend. Remarkable calcites were found here: lovely phantom crystals, crystals to 6 inches and longer, sometimes yellow in color, sometimes virtually colorless. Many are scalenohedrons, while others display rhombohedral terminations.

Limestone is not the only type of rock in which calcite is found. Like fluorite and other common gangue minerals, calcite is a frequent member of the noneconomic suite of minerals, or gangue minerals, in an ore deposit. The British iron and lead ore deposits that were worked vigorously during the Industrial Revolution yielded marvelous, now classic, calcites. They showed a variety of crystal forms, including superb twins. The calcites from here were so superb in crystal form and so abundant that most were saved.

One of the more interesting items that came out of these mines was crystal boxes. Crystal boxes were created by the miners who worked in those English lead and iron mines. A miner would gather the loose calcite crystals that broke away from the walls during blasting. At home, they would line an empty dynamite box with plaster of Paris and stick the single crystals into the plaster to create an artificial crystal-lined vug, or "vugh," as they would say. Sometimes, they would decorate their box to look like a gothic window. The highlight of this crystal box era came when miners actually competed to create the most beautiful crystal box! Cash prizes were sometimes awarded. I've only seen a couple such boxes on trips to England. Most have been broken apart and the crystals salvaged for sale.

The huge copper deposits that have been worked in the American Southwest, in Michigan, and in Central and Western Africa have not only produced wonderful water-clear calcites but, on rare occasions, spectacular red, yellow or green calcite specimens.

Calcite is also a common mineral in volcanic regions. The basalts of the Rio Grande do Sul, Brazil, area, the Deccan Plateau of India, and the American Northwest and Northeast all have been prolific producers of calcite. No wonder the mineral is commonly offered for sale by dealers. These environments yield every common form of calcite and, in some cases, unusual rounded crystals with myriad faces. Others are typical scalenohedrons or lovely thick trigonal crystals.

Calcite forms in the hexagonal system, so crystals generally show six sides, but not always. Sometimes there are three dominant prism (side) faces with the other three faces nearly nonexistent. The terminations seen can be four-sided or rhombic, triangular or five-sided. The terms used to describe calcite crystals range from obtuse to acute rhombohedral, and from thin tabular scalenohedral to long prismatic, and these do not even address the vast number and variety of crystal modifications, or the twinning habits of this mineral!

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Calcite *from page 22*

The sharply pointed calcites can be downright injurious if you are not careful. On a collecting trip we made into a mine on the Gila River Indian Reservation, we collected some wonderful dogtooth calcites that literally covered the walls of a huge stope. We could pry loose huge plates, the size of which was limited only by your ability to carry the piece! One of the fellows with me managed to break loose a great slab of pointy scalenohedral crystals. He loaded it in his backpack for the trip out of the mine, which was located at the base of a cliff high on the side of a mountain. The trail down from the mine was a very steep path across loose dump rubble. Unfortunately, the fellow with the huge calcite slab in his backpack lost his footing and tumbled down the slope. He was OK, but he had made the mistake of putting that big slab of crystals in his backpack with the crystals toward his back! We didn't have enough Band-Aids to plug all the puncture holes he got!

Calcite has a hardness of Mohs 3, so it is not suitable for jewelry. That's unfortunate, as it can be very lustrous. Still, it does occur in huge masses of travertine onyx that are quite suitable for decorative uses. Calcite also has perfect cleavage, which means any sharp blow will damage a crystal badly. In fact, this property of a perfect cleavage is important, since optically clear calcite can be cleaved into thin, transparent plates, which can be used in optical instruments. The famous Nordan bomb sight used in World War II used a slice of calcite in its optics because calcite is double refractive. This means it will split a single drawn line into two parallel lines, quite an interesting and useful phenomenon.

On one of our trips into Mexico, we went into the La Fe Mine, a calcite mine that was actually a deep-dipping volcanic vent that nature had completely lined and filled with calcite blades, the type normally called butterfly calcites. These are snow-white, flattened crystals maybe ½ inch thick and a foot or so across that fan out in huge clusters you can hardly lift. The walls of this volcanic vent were completely lined with these clusters, some of which were tinted a light pink, probably with iron oxide.

What was interesting about this deposit was that the thick layer of butterfly plates jutting from the walls was sitting right on top of a fine layer of optically clear, double refracting calcite. This deposit was important during World War II, as it supplied this important wartime mineral for industrial and electronic purposes. To mine this precious commodity, miners had stripped the butterfly crystal groups from the walls, tossing them aside as worthless, and mined the double refracting crystal layer underneath.

Naturally, collecting calcite here was a lark. It wasn't a matter of digging and hammering, but of selecting undamaged crystal groups scattered about on the floor! To my knowledge, that mine is still accessible and there is no way all that calcite could have been carried off! As an aside, when we came down off that mountain it was dark, so we camped at the first flat area we came to. The next morning, I walked around and picked up boulder after boulder of lovely, bright yellow and red jasper. It was all over the place!

Along with the crystallized form, calcite comes in a number of interesting, useful forms. The chalk your teacher threw at you for misbehaving is actually organic calcite formed by microscopic sea creatures. Fossil shells tend to be largely calcite or its paramorph, aragonite. Then there are alabaster and onyx marble, which the lapidary uses for a whole assortment of inexpensive trinkets and touristy items.

Hot spring waters often bring dissolved calcite to the surface to form travertine flows in multicolored, banded material. Mexico is famous for its travertine onyx and Pakistan has come on strong as a major source of this lapidary material. Now you can buy just about any decorative object made from Pakistani calcite onyx.

When calcite is subjected to extreme heat and pressure, it forms one of the most important artistic and construction materials, marble. Our capitol building and national monuments are made of marble brought from several places including Carrara, Italy, the marble quarries of Vermont, and a fine quarry in Colorado appropriately named Marble. The Tomb of the Unknown Soldier is made from a huge block of marble from Marble!

But the Frugal Collector is more interested in specimens for study and display. As far back as the earliest days of mining in Germany, fine calcites were found along with rich silver minerals. Calcite in a variety of crystal forms was mined here. Few of these classic specimens are seen today, but one turns up now and again.

Surprisingly, some of the superb calcites that were mined in England are still seen on dealer shelves even though the mines shut down decades ago. This means huge numbers of calcites were found during mining. Many of them are highly sought classics. Gemmy heart-shaped twins, sometimes lightly dusted with red iron oxide, are much prized. Twins that look like rabbit ears also came from here, but are seldom seen now.

Clear double refracting calcite in slanted rhombic crystals is usually called Iceland spar simply because huge, clear, scalenohedral crystals were found on that volcanic island. With calcite's perfect cleavage in three directions, these huge crystals could be broken into useful shards for optical applications.

The property of cleavage in calcite was first written up by the French mineralogist Rene Just Hauy. Rumor has it that he acci-

Simple scalenohedrons are commonly found in the limestones of the Midwest. This one is from the Sweetwater Mine in Missouri.

Surrounded by butterfly calcite crystals, we easily collected specimens at the La Fe Mine in Durango, Mexico.

dentally dropped a crystal, which shattered into lovely, perfectly rhombic pieces. This triggered his fertile brain and he studied and wrote up the property of cleavage. You can still see Hauy's original calcite cleavage pieces displayed in the French Museum of Natural History in Paris.

In the United States, the first important finds of calcite happened in New York State. In northwestern New York, huge, gemmy crystals of calcite were found, perfectly formed and weighing tens of pounds. Even today, you can collect small gemmy crystals in open vugs in the Niagara limestone that dominates the region. Perhaps the most noteworthy calcite locality in New York was at Rossie, where this mineral was found in superb gemmy modified scalenohedrons during the mining of metal ores. Even more spectacular were the calcites found at Sterlingbush; here, a limestone cave yielded amazing calcites of exceptional quality and of huge size, some of them tipping the scales at a half ton!

Of course the Frugal Collector has little chance of obtaining calcite from most classic sources, though the odd crystal group does show up now and again. So what should you look for when at a mineral show?

First, I'd attend as many shows in the Midwest as possible or check out shows with a selection of Midwestern dealers. Local dealers in calcite-producing areas are usually loaded with lovely calcites obtained from collectors who work the operating or abandoned quarries and mines. The states of Illinois, Indiana, Kentucky, Ohio, Missouri, and Tennessee are particularly fruitful. Their calcites range through every color and tint from white to pale yellow to rich honey colored, thanks to traces of metallic or organic inclusions.

Among my favorite Midwest calcites are those from North Vernon, Indiana. These small, highly modified, honey-colored gems are lustrous and quite complex, appearing nearly round. Many of them show twinning, as well.

During the last 100 or so years, the tri-state area of Missouri, Kansas and Oklahoma became world renowned for its galena, sphalerite and calcite combination specimens. Amazing quantities of calcite on gray limestone came to grass here. The crystals ranged from inch- to foot-long scalanohedrons and other crystal forms. Crystal colors ranged from white to oatmeal to gray to an occasional lovely pale violet. All are fine examples of this lovely mineral and are still to be found in dealer stocks at reasonable prices, except the lovely violet crystals and the twinned types, like fishtail twins, which are not to be seen any more.

More recently, the Elmwood, Tennessee, area has been producing some of America's finest gem calcites. The deposits here were found by measuring magnetic anomalies sensed from aircraft flying a crisscross pattern over the region. The Elmwood calcites come in a wide range of sizes, some of them huge. Miners have reported crystals so large they were able to slide down their faces, scooting down into huge open cavities filled with fine minerals. Most of the Elmwood calcites are a lovely amber or orange color due to included organic material. Left in bright sunlight, the crystals' color fades. Most of these calcites are gem clear and have been faceted into brilliant display gems weighing several hundred carats! Accompanying these calcites are equally gemmy colorless, blue, violet, and tinted fluorites in large, simple cubes. Often the cubes have been etched into odd forms. Again, the fluorites can also be faceted into several hundred carat gems. What the Frugal Collector should look for here are the smaller sizes of these orange calcite beauties. They are superb display specimens.

The Upper Peninsula of Michigan is world famous for its huge, now depleted, copper deposits, which were worked starting in 1844. Every collector knows of the wonderful native copper specimens and even more valuable native silver specimens that were found here in abundance. For the calcite collector, this area might be considered the mecca of calcite collecting. Here, the calcites were often found completely enclosing bright native copper crystal sprays. Some crystals were so jammed with copper as to appear completely full of the red metal. Others hold delicate arborescent crystal sprays of copper. Needless to say, these specimens are highly prized and highly priced! And they are scarce. Any Frugal Collector who finds a copper-rich Michigan calcite crystal and can afford it is surely lucky!

Mexico has been producing calcite crystals almost continuously for decades. The mines of the Chihuahua and Durango areas have regularly produced huge quantities of this mineral. One Durango area has produced vast quantities of sparkly brown scalenohdrons, usually an inch or so long, in nice cabinet-sized groups. These nice crystals show up even today. More exciting and still readily available are the fine, white poker chip calcites from Mina San Sebastian, Charcas, San Luis Potosi, Mexico. These crystals are seen in clusters resembling a stack of poker chips that has been tipped over. The crystals tend to be under ½ inch thick, but can be several inches across the flat face. The largest reported Mina San Sebastian calcites measured well over a foot across.

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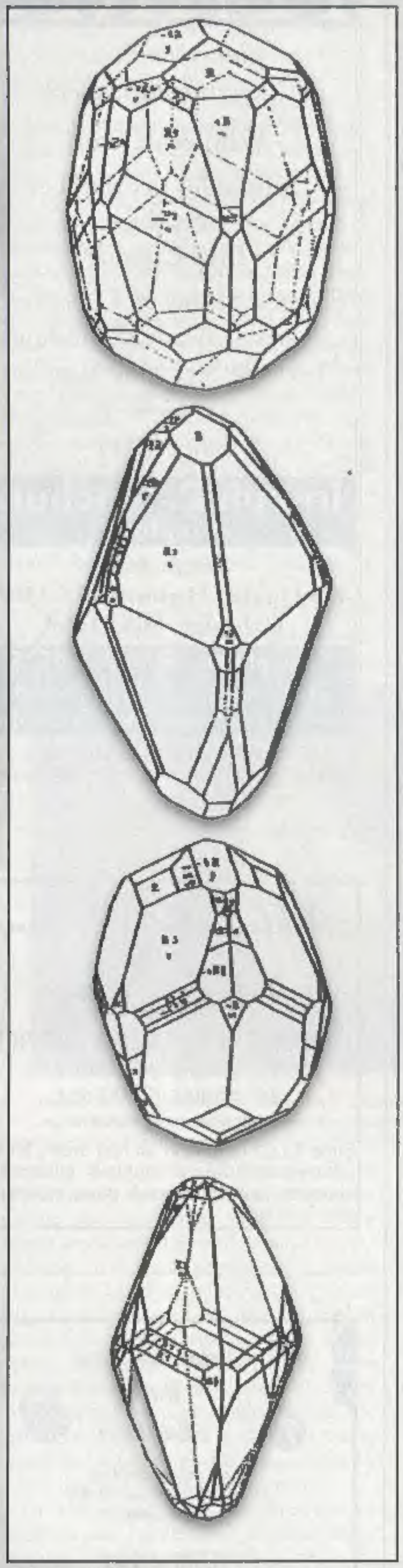
Calcite *from page 82*



Michigan's Keeweenaw Peninsula copper mines also produced complex calcites like these.

Calcite can develop into some strange formations.

Another Mexican locality that produced lovely crystals, many of them twinned, was in the remote regions of Cobra Del Baranca, or Copper Canyon. This vast land, home of the Tarahumara Indians, is a canyon actually larger than the Grand Canyon. The Porvenier Mine, high on the canyon wall, produced some of Mexico's finest calcite twins. Its crystals had an arrowhead shape and measured up to a couple of inches across. Their crystal surfaces seem slightly etched, but these are growth lines that do not detract from their value.

The copper mines of the Southwest have been a ready source of calcite. The miners at Bisbee, who penetrated the huge limestone deposits to reach the highly mineralized copper ore deposits, found calcites in huge quantities and of every form. Some looked like snow-white organic life and are termed coralloidal. Others were perfect scalenohedrons. The prize calcites from this mine came in one of two colors, bright red or luscious green.

The red Bisbee calcites get their color from included microscopic red chalcotrichite, the acicular form of cuprite. Nearly blood red in color, these crystals are often tiny, sometimes associated with native copper. Only rarely is a specimen of this colorful type of calcite seen on dealer shelves. The same is true of the green malachite-included Bisbee calcites. These were found in just one mine. The best are inch-long calcites jammed full of hairy green malachite and usually nested in free-form acicular malachite. Again, on rare occasions you might see a very small cluster of this type of calcite. If you do, snap it up. It's a Bisbee classic.

Another Arizona mine that produced colorful calcite is the Pearl Handle Pit at Ray. One significant find was made of small calcite crystals infused with chalcotrichite, which gave the calcite a color that ranged from blood red to bright yellow. Only a handful of these crystals were found, so chances of finding one available are next to nil.

Another colorful calcite variety was mined at Tsumeb, Namibia. The mine is now closed, though a collector group has been trying to recover specimens. During mining operations, vast amounts of calcite came to light. Instead of the usual scalenohedrons, the crystals were in stepped growth with rounded edges, and were very attractive. The better specimens were colored green from included dioptase. These were snapped up quickly, so are not available now. Still, huge amounts of Tsumeb calcites were brought out, so you can still find a nice group now and again.

Once Russia opened up to foreign travel, a flood of fine minerals began to reach the Western countries. From the remote Dal'negorsk mining area in Siberia, wonderful light green fluorites were being sold. Then, along came really spectacular Dal'negorsk calcites. These crystals were often 4 or more inches on an edge in rounded rhombic form, with sparkling internal cleavage planes that simply

added to their attractiveness. In some ways these calcites resembled the calcites that came out of the deep copper sulfide mine at Superior, Arizona, but in much greater quantities.

Mining in the Magma Mine at Superior was a real task because the deeper the miners penetrated, the hotter the mine became. It finally had to be air conditioned. Even so, when I went down to the 4,800 foot level on a magazine assignment, the humidity and heat were almost smothering. The temperature of the rock face was reported to be 148 degrees F!

One of the things I like about calcite is its odd shapes. When found in cave environments, it often develops twisting, curling growths. The limestone caverns in Florida, for example, are a really interesting source of calcite in odd shapes curving, twisting and curving in every conceivable way and forming attractive and unusual forms.

One of the most interesting properties of calcite is its luminescence, its ability to respond to energy excitation. Not all calcite will respond, but much calcite will respond to ultraviolet energy, even weak. Ultraviolet radiation comes in two commonly used forms, short-wave and long wave. Calcite responds variously, depending on the type of radiation used. Perhaps best known is the brilliant red-fluorescing calcite from Franklin and Sterling Hill, New Jersey. My personal favorite has always been the calcite cleavage pieces from the mercury mines around Terlingua, Texas. This calcite will glow a lovely pink under ultraviolet light, but after the lamp is shut off, the calcite continues to give off a lovely soft blue glow. While this material is in short supply, a new deposit in Mexico has produced huge cleavages that act the same way. Some of the pieces I've seen are a foot or more on an edge, and quite remarkable.

So, anyone who collects calcite has to be armed with an ultraviolet lamp that produces both long- and short wave energy. Check every piece. Sometimes, a nondescript cleavage piece turns into a worthy display specimen only because it reacts beautifully under ultraviolet light.

Calcite is certainly one of the more exciting minerals the Frugal Collector can collect. It has so much to offer. It is an abundant mineral, so it can be found in all price ranges. It comes in so many crystal forms, from easily identified to very complex, that you can actually use it to get a start on studying crystallography. Best of all, it is very showy, often quite inexpensive, and can be displayed prominently in any mineral cabinet.

TROPHY NUGGETS AT GANES CREEK, ALASKA

Metal Detectors Find Big Gold

What a thrill it was to find this 5.6-ounce, quartz-laden nugget! (Photos by the author.)

by James A. Miller

Alaska has numerous placer mining locations that have produced large gold nuggets in the past. Most of these locations are mined out or are not accessible to the recreational prospector. Ganes Creek is an exception. A couple of years ago, the Clark Wiltz Partnership, owner of the Ganes Creek property, began accommodating metal detecting enthusiasts who were interested in prospecting the miles of old placer tailings for gold nuggets that were missed by the old-timers. After some striking success from these early detectorists, the Ganes Creek operation began accepting a limited number of recreational prospectors for weeklong excursions to the property in 2002.

The Ganes Creek property consists of about 15 miles of patented mining claims located on Ganes Creek and its tributaries. Gold discoveries were made in the Ganes Creek vicinity in the early 1900s, a few years after the start of the Klondike Gold Rush. Placer mining at Ganes Creek began in about 1906 and has persisted nearly continuously since that time. Over the span of almost a century, the Ganes Creek property has produced approximately 250,000 ounces of placer gold. The Ganes Creek claims have a reputation for producing some very large gold nuggets. The old-timers recovered a *huge* nugget weighing 22 ounces. Nuggets in the 5-ounce class are not uncommon at this location.

When I heard about the impressive nuggets being found at Ganes Creek, my serious case of gold fever got the best of me. I have always dreamed of finding a big gold nugget, and Ganes Creek seemed to offer a reasonable opportunity to fulfill that fantasy. So I booked my reservation to the Ganes Creek mining camp. One of my biggest challenges in preparing for the Ganes Creek adventure was managing my expectations. I likened the outing to a trophy elk hunt. I knew that there were trophies in the area, and someone in my party may score a nice one. But the odds were that it wouldn't be me.

Like these placer gold nuggets from the tailings piles, many visible gold nuggets found at Ganes Creek are small. These examples weigh from 3 pennyweight to 16 pennyweight.

The author proudly displays the fruit of six days' labor at Ganes Creek—more than 7 ounces of gold nuggets.

In late July 2003, I was on my way to Ganes Creek from Seattle. Joining me on the trip was Randy Clements, a good mining buddy from Cochran, Georgia. Richard and Bonnie Reem, from Fairbanks, Alaska, rounded out our group of detectorists. The Reems met Randy and me for the first time at Ganes Creek. Although Randy and I were reasonably experienced in the use of metal detectors, the Reems were rookies. In fact, the Reem team hoped to find its first-ever gold nugget with a metal detector.

Ganes Creek is located about halfway between Anchorage and the famous gold rush community of Nome. The nearest sizable town to Ganes Creek is McGrath, which is located on the bank of the Kuskokwim River. Summertime access to McGrath is by air only, but this little community has an excellent paved runway and is served by daily commercial flights from Anchorage. A local charter service flies prospectors from McGrath to Ganes Creek in a scenic, 20 minute flight (weather permitting).

Approaching the Ganes Creek airstrip for landing, many isolated ponds and tailings piles are visible from nearly a century of placer mining operations. The mining camp consists of numerous metal-roofed buildings, including five buildings for housing guests, a cookhouse, and a greenhouse. The camp can accommodate about 12 visitors at a time and boasts a small community building with satellite TV, hot and cold running water, showers, and laundry facilities. So while the Ganes Creek mining camp isn't a five-star hotel, it's certainly not "roughing it" by Alaska standards.

The camp owner and hosts, Doug and Kathy Clark and their son Dan, are delightful and try their best to keep their guests comfortable, well fed, and on the gold trail. Prospecting guests are assisted by Dave Rankin, an experienced metal detectorist who helps newcomers get familiar with the property and find much-treasured gold nuggets. Dave is about as likable a guide as you could hope for.

The name of the game for gold hunting at Ganes Creek is finding nuggets missed by past placer mining operations. These nuggets hide in the myriad tailings piles that occupy the mining claims. Although the nuggets are infrequent, the size of the nuggets in the tailings piles can sometimes be remarkable.

Initial commercial mining at Ganes Creek was done with a floating bucket dredge. The derelict dredge, not used for about 50 years, is located a few miles downstream of the Ganes Creek camp. This piece of equipment scooped up the stream gravel down to the fractured bedrock, emptied the excavated material into the interior of the dredge, discharged oversize material out the back of the dredge, and processed the smaller material through a series of sluice boxes inside the dredge. The process of dredging actually created a pond for floating and moving the dredge. Waste tailings (including occasional nuggets) were deposited behind the dredge as it excavated its way into new pay dirt. Gravel larger than about 2 inches in diameter was discharged as oversize by the Ganes Creek dredge. Therefore, really large nuggets would not have been recovered in the sluice boxes and would have been dumped in the tailings piles, unless they were spotted by an attentive dredge worker.

After the 1950s, most commercial mining in the Ganes Creek valley has been done with a dragline dredge. Pay dirt excavated by the dragline is processed to remove oversize material and then passed through sluice boxes. Although dragline operations may be more efficient in recovering nugget gold than the older bucket dredging, experience has shown that many gold nuggets also are contained in the dragline tailings.

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Trophy Nuggets at Ganes Creek, Alaska *from page 29*

Early metal detecting enthusiasts at Ganes Creek walked the miles of tailings seeking nuggets near the ground surface in old tailings piles. Some incredible successes occurred in searching these tailings, which had never before been exposed with metal detectors. Even the claim strip (constructed of old mine tailings) produced nuggets in the 5-ounce class. But by the time I arrived in late July 2003, I was hard pressed to find any tailings piles that did not have the telltale footprints or "dig holes" of someone who had been there before me. Ah, but all was not lost!

Modern metal detectors can find large gold nuggets up to a depth of 24 inches or so. Small nuggets are detectable at shallower depths. This means that only the exposed veneer of the tailings piles and bulldozer roads had been searched for gold. The vast majority of the gold nuggets missed by past mining activities are still contained in the tailings at depths beyond the reach of metal detectors. All one needs is a way to get at them!

Fortunately, the Ganes Creek mining camp has a fleet of operational mining equipment, including three bulldozers, a large front end loader, a road grader, a dragline dredge, and a large tracked backhoe. The Clarks assist their metal-detecting guests by bulldozing the tailings piles to expose new ground for detecting. All of the nuggets found during our visit were produced from tailings that had been freshly "plowed" by the bulldozer.

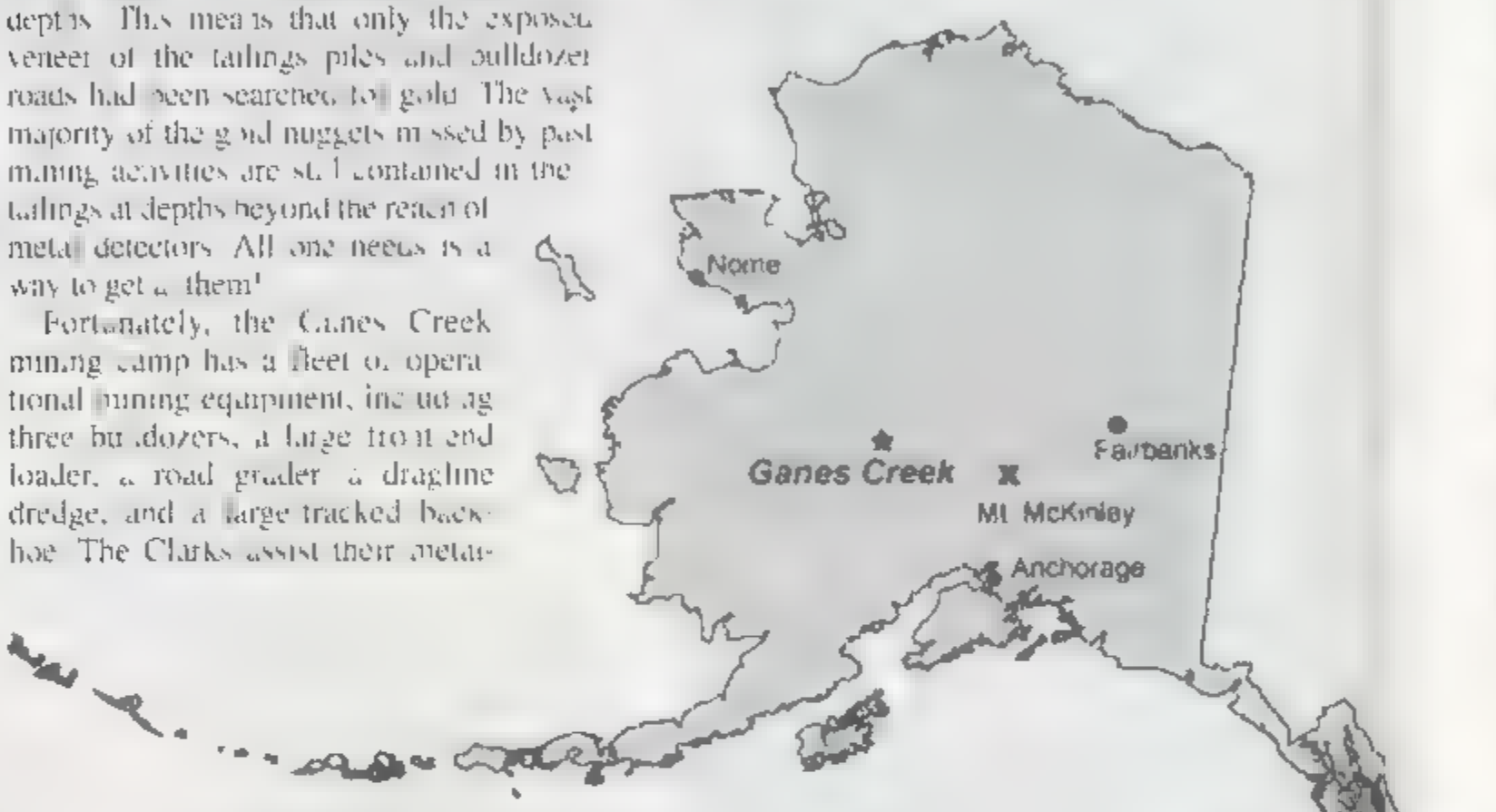
Any modern metal detector is capable of detecting large gold nuggets. Smaller nuggets may escape unless detectors specialized for finding gold nuggets are used. Randy and I searched the tailings using new Fisher Gold Bug 2 detectors. The Reem team shared a White's GMT detector, "fresh out of the box."

Past placer miners at Ganes Creek were not bashful about discarding all types of metal trash in the mine tailings. We found tin cans, large bolts, rivets, flat pieces of iron, bullet castings, chain, lead bullets, battery posts, copper wire, aluminum wire, and more. The iron discrimination mode of the Gold Bug 2 and White's GMT saved us many hours of digging no. rocks and false targets. Still, we dug many promising targets, only to be disappointed to find yet another .22 shell and the like.

Our first couple of days at Ganes Creek were devoted to "wandering around" and looking for nuggets in areas that had already been hit pretty hard by previous visitors to Ganes Creek without luck. But that changed once we started detecting tailings freshly exposed by bulldozing!

After two days of frustration, I had found my first nugget at a depth of about 6 inches. It was a beauty, weighing in at about 6 pennyweight (0.3 troy ounces). This ice breaker was nearly round, with about 15 percent visible quartz. That got me going! Later that day, I found a half-pennyweight nugget that also contained quartz. Things were looking up!

I soon learned that nearly all of the coarse nuggets at Ganes Creek contain visible quartz. One .52 ounce quartz cobble found in the summer of 2003 contained approximately 95 percent quartz and 5 percent gold. To date, no one has found the probable hard rock source areas for the Ganes Creek gold, but with quartz-rich gold nuggets this large, the "mother lode" source areas must be close at hand.



The Ganes Creek property includes many isolated dredge ponds and tailings piles from past placer mining operations.

On the morning of our fourth day, I found what, at the time, was the largest gold nugget of my 25 year recreational prospecting career. When I pulled this chunky nugget out of the hole, I thought for sure it would top an ounce. However, it came up a little short, weighing in at 16 pennyweight (0.8 troy ounces). Now I was really jazzed! Randy nailed a 7 pennyweight nearly shortly thereafter. But after four days of diligent searching, and considerable coaching from Dave, the Reem team was still batting zero.

It can get pretty disheartening digging target after target, only to discover more trash metal. By day five we were getting a little discouraged looking for the elusive trophy nugget. However, the "brag" pictures of groups that had visited Ganes Creek earlier in the summer kept us motivated.

While prospecting late in the morning of the fifth day, my Gold Bug 2 sounded off with a sharp "bleep." When I switched to iron ID mode, the signal remained strong and steady with an increase in pitch. What have we got *this* time? I wondered. I got

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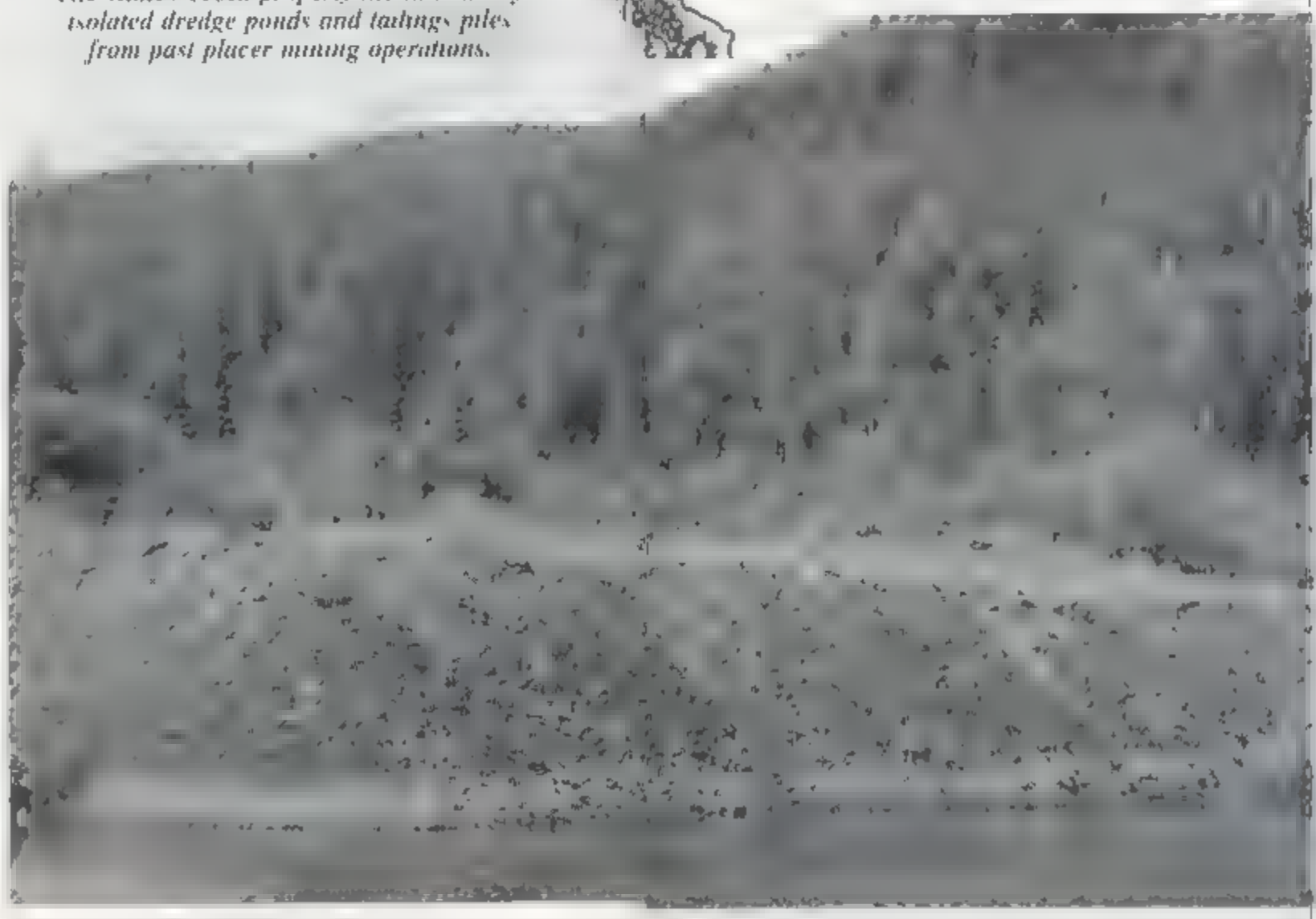


Trophy Nuggets at Ganes Creek, Alaska *from page 31*

down on my hands and knees and began digging through dragline tailings that had been freshly exposed by the bulldozer. My back was killing me by the time Randy came over to take a rest and watch me dig.

When my dig hole was about 10 inches deep, I passed my detector over the target again. My Gold Bug sounded off as it had done many times before over large chunks of metal junk. Randy and I both guessed that my current target was a big piece of iron or another tin can. But Randy passed on his words of wisdom: "When there is big gold around, you *have* to dig these targets!" So I continued digging with my hand pick. Twelve inches deep there was still no target in sight, but my detector was screaming.

At a depth of 14 inches, my pick pulled up a gold nugget so large that all I could say was "Holy smokes, look at this!" I was speechless and amazed. *I had found my trophy nugget!* Bigger than a golf ball and loaded with crystalline quartz, this time of a lifetime tipped the scale at 5.6 ounces, including quartz. My quest had been fulfilled!

While I took the afternoon off to explore the bench placer area near camp, Randy and the Reem team continued metal detecting on the afternoon of day five. Although Randy found some small nuggets, the Reems continued to be skunked. It wasn't for the lack of effort; they kept at it with diligence, and they were able to detect test targets easily. They just weren't putting their detector in the right place at the right time.

Day six was our final day of metal detecting at Ganes Creek. The early morning produced two small nuggets for me at one end of an area that had been bulldozed the previous afternoon. Dan arrived in midmorning, climbed on the bulldozer, and pushed some more tailings out of the way for the detecting crew. We began finding new nuggets almost immediately. Randy found a gorgeous 1-ounce beauty, the largest nugget he had ever found in his 15 years of metal detecting. And the Reem team found gold on their last day! They nailed four nuggets in the space of a couple hours, including a 7 pennyweight beauty that will make a spectacular pendant. After five days of false alarms, smiles finally filled the faces of Richard and Bonnie. In all, we found a total of 12 nuggets on day six. What a great finish!

Metal detecting isn't the only way to find gold at Ganes Creek. During my six-day visit, I spent a total of perhaps eight hours on the bench placer above the camp using a high banker, pan, and sluice box to search for "fine gold" in the fractured argillite bedrock (metamorphosed siltstone). One of my pans must have produced at least 80 flakes of gold, including some little "pickers." In all, I returned home with nearly 6 pennyweight of small nuggets and flake gold from the bench placer. Almost anywhere else, that is a good haul for eight hours of recreational prospecting, but with 5-ounce nuggets lurking about in the tailings piles, the beach placer area tends to get ignored at Ganes Creek.

In all, our detecting crew found and took home nearly 11 ounces of gold nuggets from Ganes Creek. I was definitely the lucky prospector on this trip. My trophy nugget accounted for about half of the total gold weight recovered. My good fortune proved that there is a chance to find a big one at Ganes Creek! All it takes is diligence and a healthy measure of good luck.

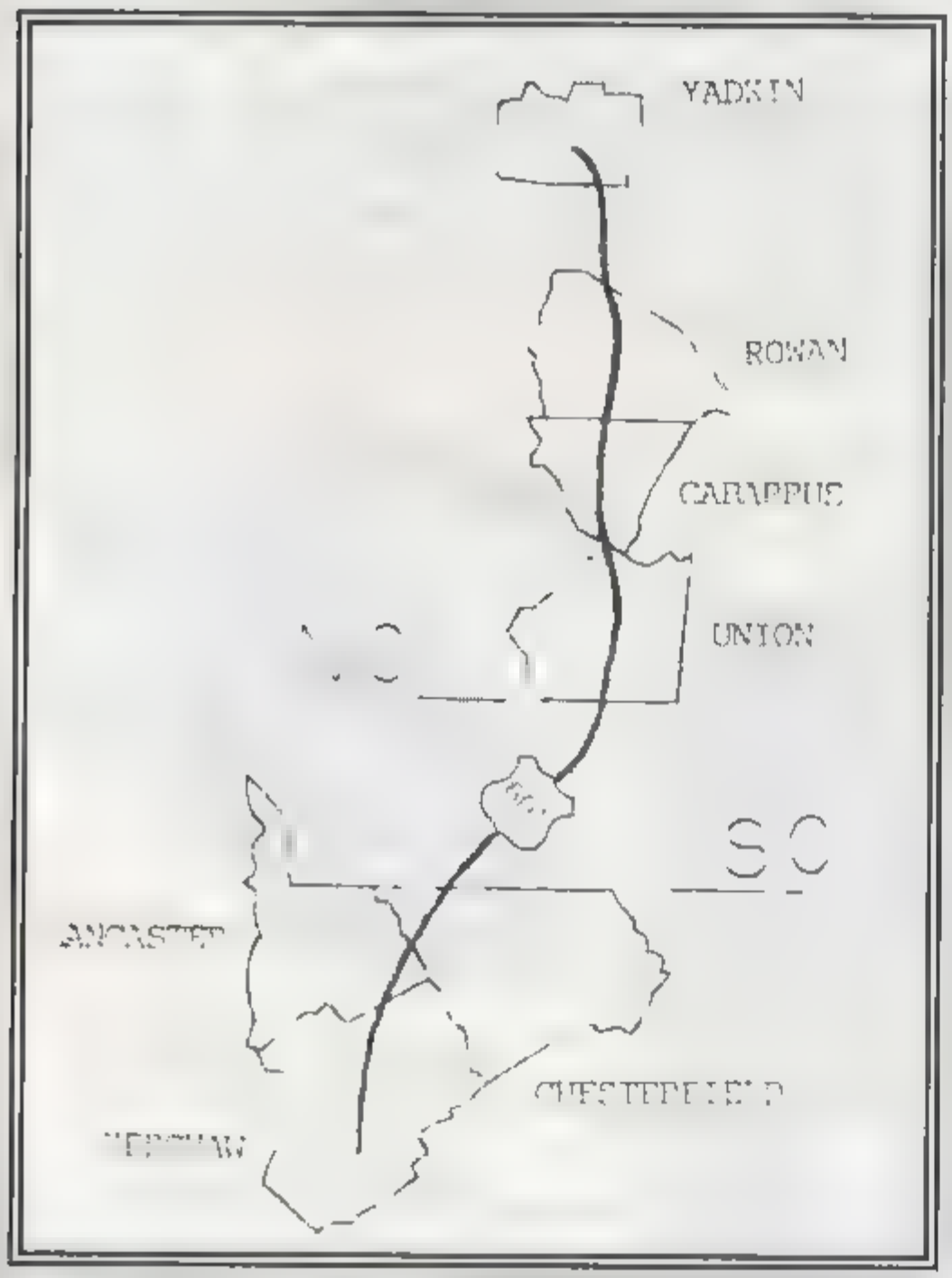
If you would like more information about searching for gold nuggets at the Ganes Creek property, write to Doug Clark at Clark/Waltz Mining, PO Box 586, Talkeetna, AK 99676. You can also call (907) 733-2488, or (907) 524-3614 after June 15, or visit www.akmining.com/ganes.htm.

Randy Clements digs a target in freshly bulldozed dragline tailings. Modern metal detectors can find large gold nuggets at depths of up to 24 inches.

GOLD AND GEM HIGHWAYS

PANNING SITES ALONG U.S. HIGHWAY 601

Seven Sweet Spots in North Carolina and South Carolina



by David and Clois Walker

This article is essentially extracted from our previous state-wide studies in the Carolinas, limited to gem and mineral panning sites at selective highway/stream crossings along U. S. Highway 60 , where appreciable finds have been substantiated on upstream watersheds.

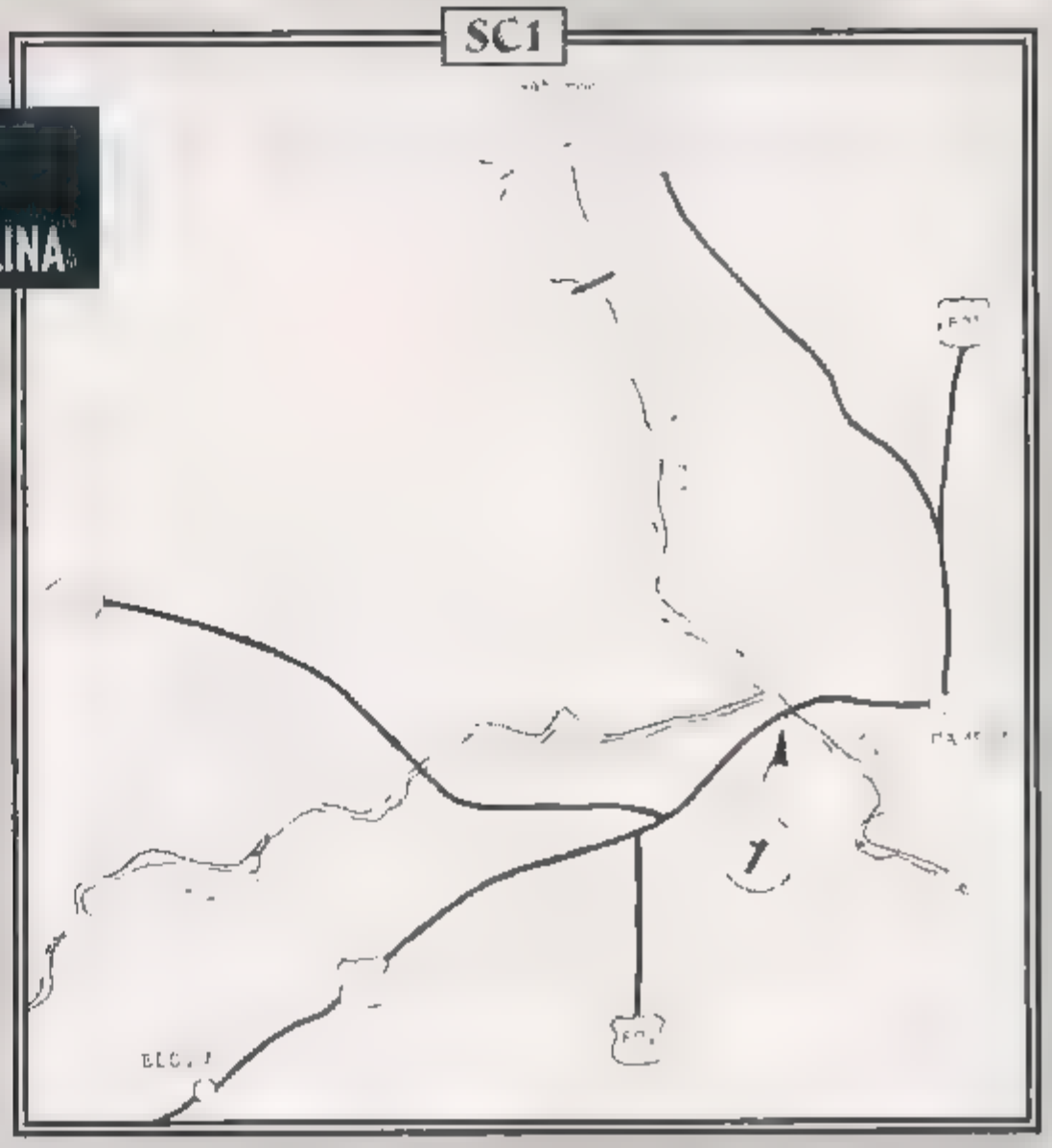
Obviously, we've relied on erosion patterns rather than personal observation, but others have proved that our speculations are reasonable and we get many requests for these maps.

The sites listed here are situated in a generally northern direction, extending from Camden, South Carolina, to Yadkinville, North Carolina. Next to each crossing, we have listed the gems and minerals one can expect to find, based on erosive patterns and the location of known mineral deposits. The corresponding vicinity maps are on an approximate scale and are provided for orientation in the field.

The principal advantage of limiting panning and screening activities to within highway rights of way is, of course, that you don't have to negotiate access privileges with land and mine owners. Local highway patrolmen will insist that you observe the various safety and environmental regulations. Other than that, about all most of us have to look out for is a little overinflated expectation!

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN KERSHAW COUNTY, SOUTH CAROLINA

SC1



LOCATION AND VICINITY FINDS ALONG U.S. HIGHWAY 601 IN THE CAROLINAS

SOUTH CAROLINA

Kershaw County (Map SC1)

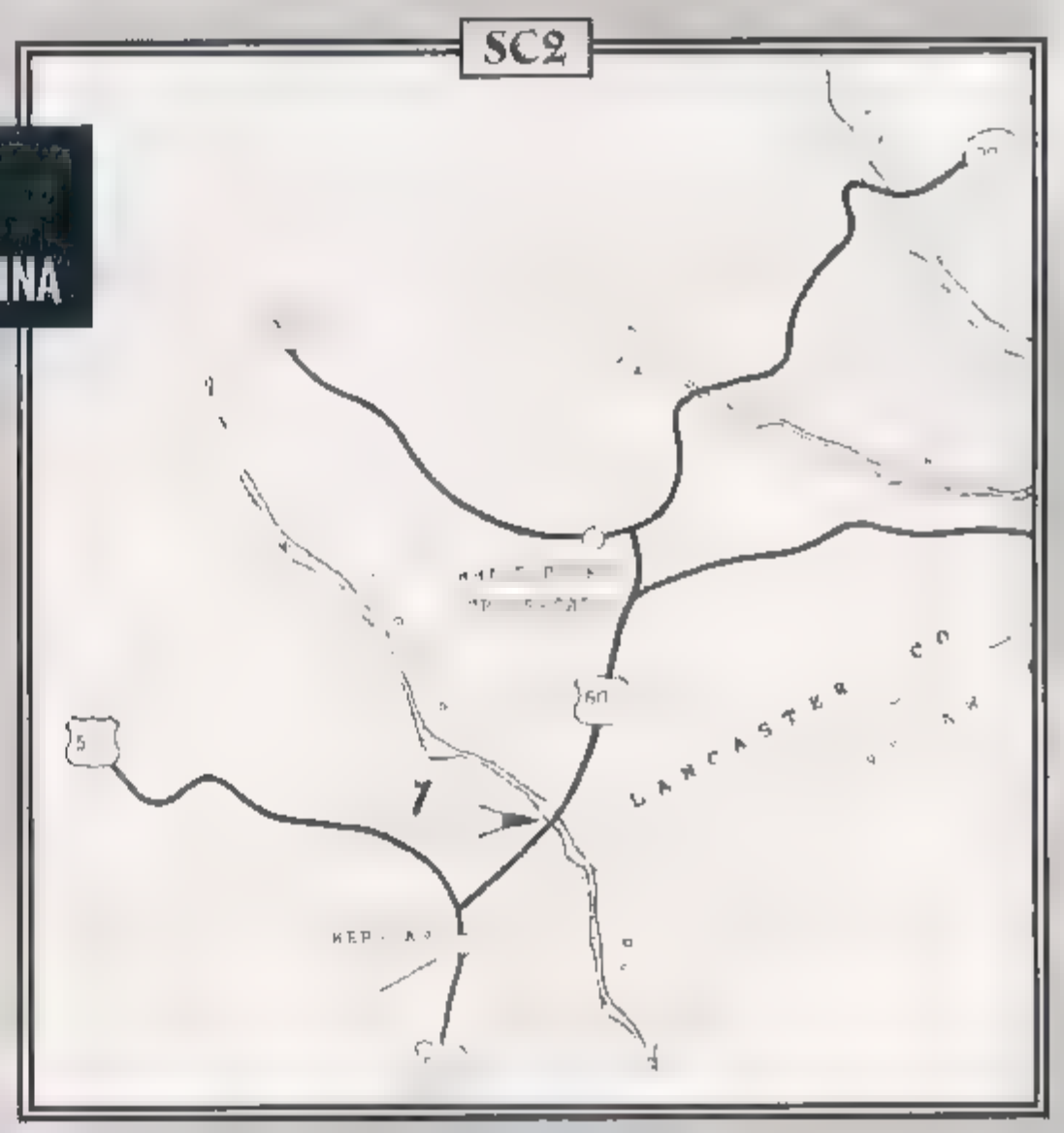
Site 1 Crossing on Wateree River, near CAMDEN Vicinity finds indicate gold potential

Lancaster County (Map SC2)

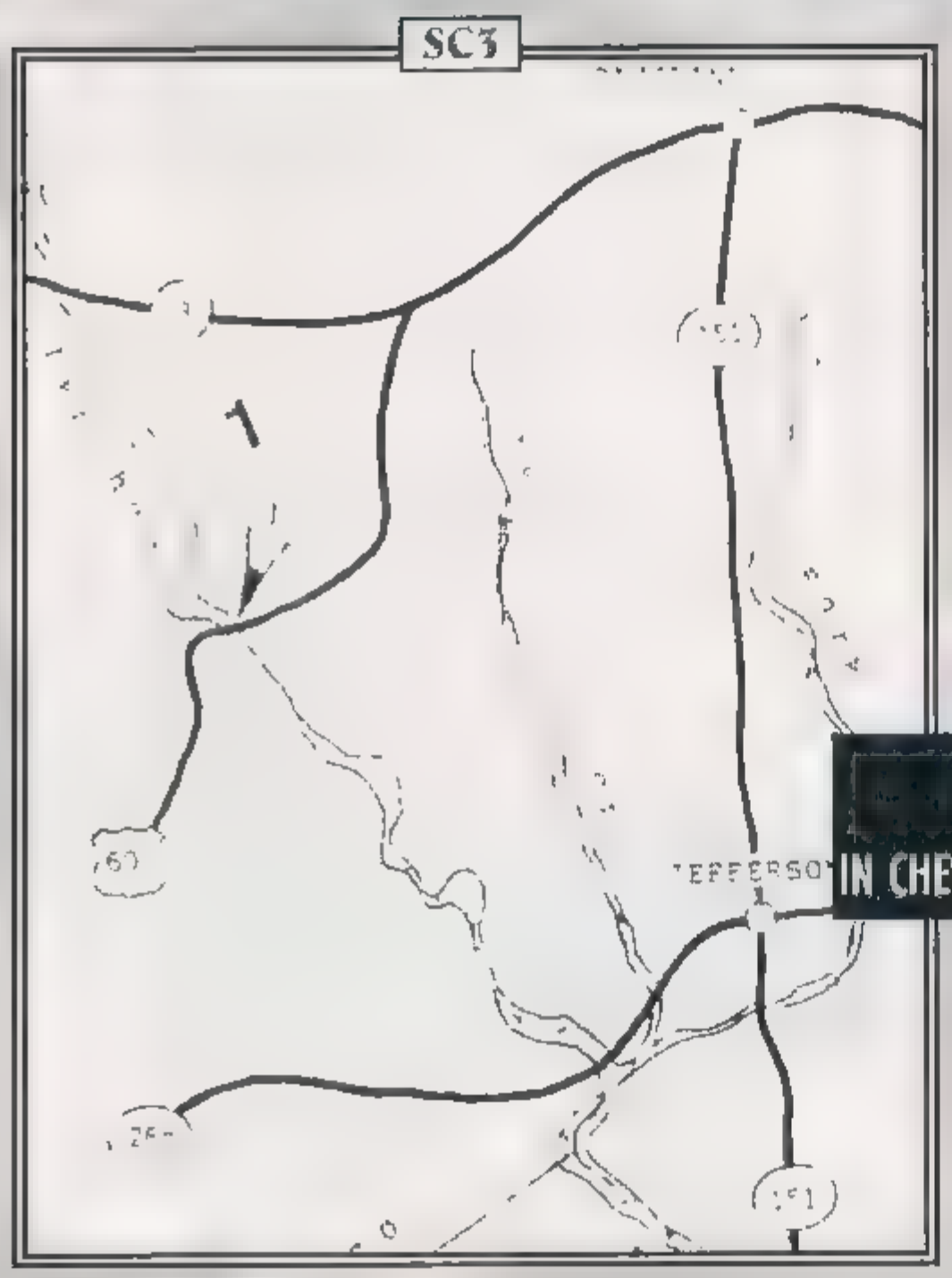
Site 1 Crossing on Little Lynches River, near KERSHAW Vicinity finds indicate gold potential

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN LANCASTER COUNTY, SOUTH CAROLINA

SC2



SC3



SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN CHESTERFIELD COUNTY, SOUTH CAROLINA

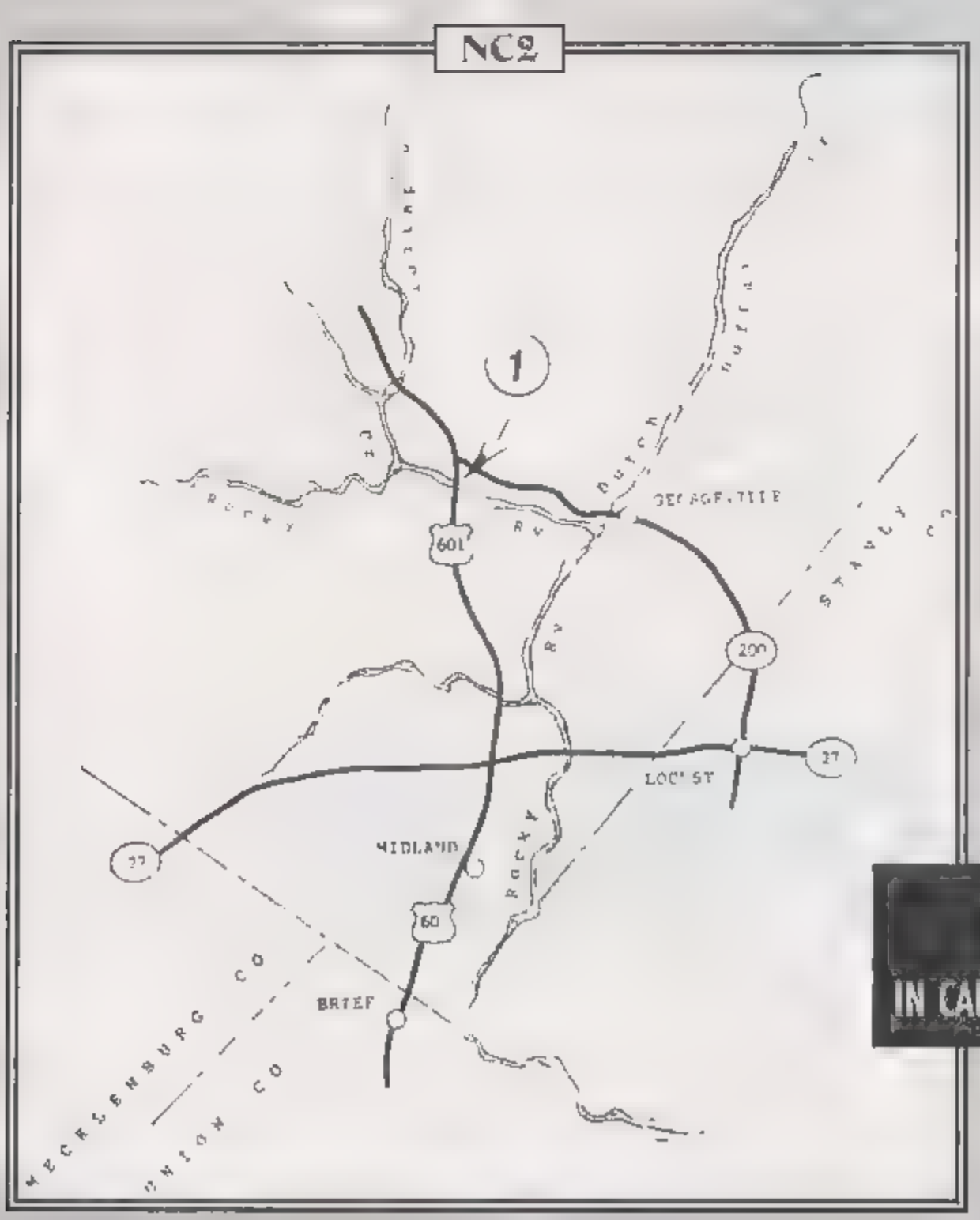
Chesterfield County (Map SC3)

Site 1 Crossing on Lynches River, near PAGELAND Vicinity finds indicate topaz potential.

continued on next page

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN UNION COUNTY, NORTH CAROLINA

NORTH CAROLINA
Union County (Map NC1)
Site 1 Crossing on Clear Creek, near BRIEF Vicinity finds indicate gold potential



Cabarrus County (Map NC2)
Site 1 Crossing on Rocky River, near GEORGEVILLE Vicinity finds include agate, gold and opal

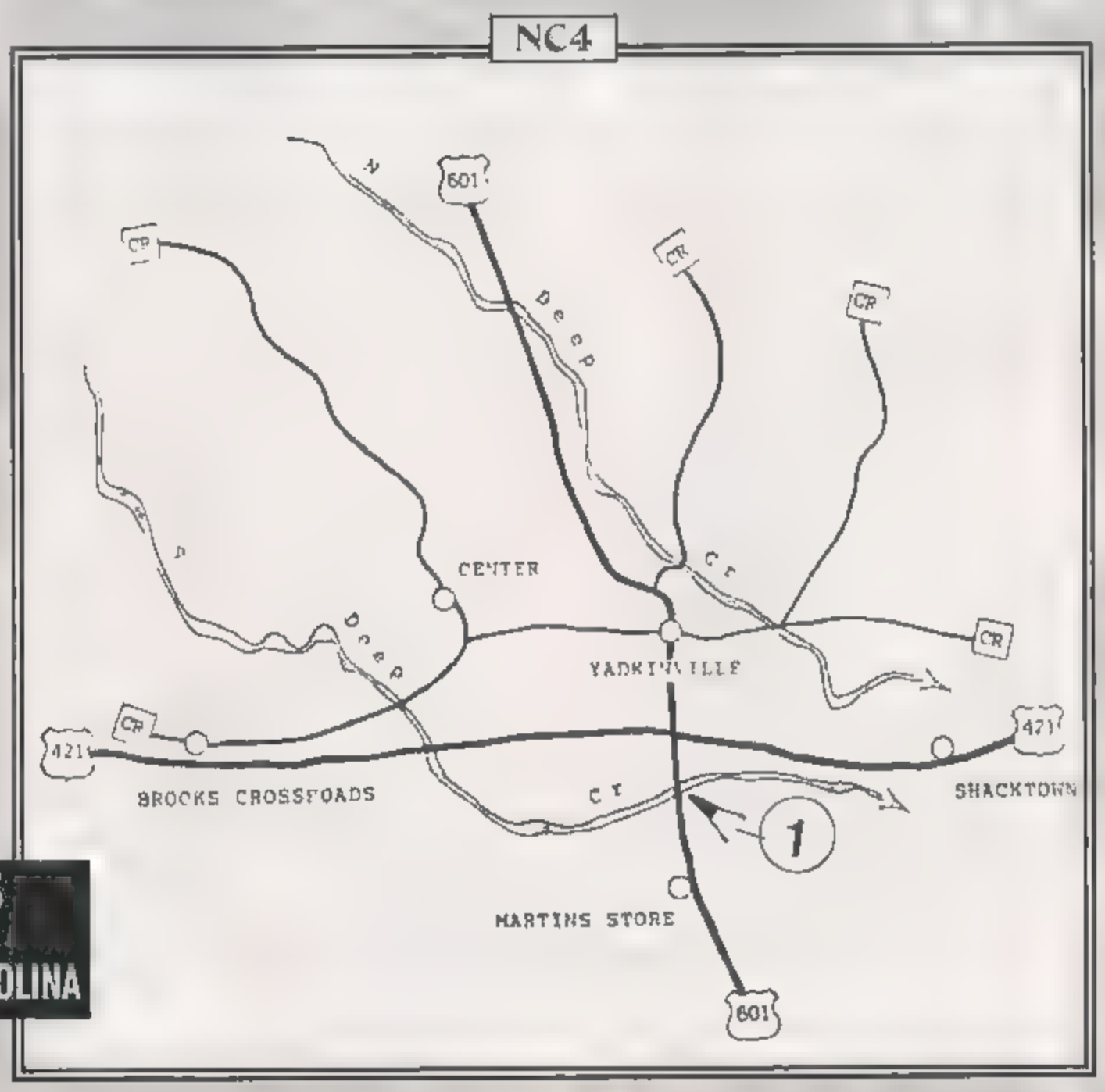
SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN CABARRUS COUNTY, NORTH CAROLINA

SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN ROWAN COUNTY, NORTH CAROLINA

Rowan County (Map NC3)
Site 1. Crossing on North Second Creek, near FRANKLIN. Vicinity finds include agate, amethyst, quartz, and tourmaline.
Site 2. Crossing on South Yadkin River, near DAVIE CROSSROADS. Vicinity finds indicate gold potential.

Yadkin County (Map NC4)
Site 1. Crossing on South Deep Creek, near YADKINVILLE. Vicinity finds include beryl, carnelian, garnet, and quartz.

The official state highway maps are suggested in conjunction with the vicinity maps for overall orientation in the field.



SUGGESTED PANNING SITES ALONG U.S. HIGHWAY 601 IN YADKIN COUNTY, NORTH CAROLINA

ROCK SCIENCE

by Steve Voynick

Sweden's Meteorite Quarry

Limestone quarries might not seem the most likely place to find meteorites, but over the past decade a limestone quarry near Kinnekulle in southern Sweden has yielded dozens of meteorites. All are fossil meteorites—meteorites that fell to Earth in ancient geological time and became assimilated into sedimentary deposits. Scientists believe these meteorites are clues to a huge asteroid collision that occurred several hundred million years ago.

Concentrations of meteorites are rare. Meteorites are found in relative profusion only in a few surface areas where conditions are conducive to their discovery, notably the barren Antarctic ice sheet and Australia's Nullarbor Plain.

Few fossil meteorites have been found in the huge volumes of coal, metal ores, and other mineral resources that have been mined over the centuries. One reason is that, over time, meteorites react with surrounding minerals and fluids, altering into nondescript masses that resemble common iron nodules. Another reason is that few miners and quarrymen have looked for meteorites.

Little fossil evidence has ever been found of the huge amounts of meteoritic material that have fallen to Earth over past eons. The few notable recoveries have included iron meteorites from Miocene sediments in Georgia, Eocene rocks in Texas, and 3-million-year-old sediments in Alabama and Ohio. Fossil stony meteorites have been found in Mesozoic bauxites in Russia and in late Cretaceous marine sediment core samples from the Pacific Ocean.

Accordingly, scientists are astounded by the veritable lode of fossil meteorites now coming from Sweden's Kinnekulle quarries in the Holen Limestone, a formation laid down in Ordovician time, nearly 500 million years ago. The first Kinnekulle fossil meteorite was found in 1952. Not immediately identified as a meteorite, it was preserved only because of its remarkable association with a marine fossil. It was in direct contact with the fossilized shell of a nautiloid cephalopod.

In 1979 paleontologists chemically analyzed the object contacting the fossil shell and found high levels of iridium and a certain form of crystalline chromite, both of which confirmed extraterrestrial origin. A second fossil meteorite was found in 1988 in the same strata, a very unlikely occurrence and one that intrigued geology professor Dr. Maurits Lindstrom of the University of Stockholm.

Lindstrom learned that quarrymen, while sawing limestone into thin slabs for use as door- and windowsills, sometimes discarded slabs that contained "impurities." He asked the workers to save those slabs, and within just four years had identified more than 12 fossil meteorites.

Dr. Berger Schmitz, a professor of marine geology at Sweden's Goteborg University, then supervised the sawing of several thousand cubic meters of limestone into inch-thick slabs and found 29 fossil meteorites—21 within a 2-foot-thick bed that represented a few hundred thousand years of geological time. That thin strata of the Holen Limestone has now yielded 50 of the 55 documented fossil meteorites ever found.

Today, meteorite activity is relatively uniform, with an average of about one meteorite per year falling every 7,700 square miles (think of a square measuring 88 miles on a side). Scientists note that the profusion of meteorites at Kinnekulle resulted from a rate of fall 100 times greater.

About 20 percent of the meteorites that fall today are remnants of what planetary scientists call the L-chondrite parent body, a large asteroid that broke apart some 480 million years ago in the largest asteroid collision in recent solar system history. Because all Kinnekulle fossil meteorites are chemically identical to the L-chondrite meteorites, scientists believe they are direct evidence of the massive meteor showers that followed the collision.

"It's true that we are lucky to be looking in just the right place," says Schmitz, "a layer of limited sediments that was forming on the seafloor immediately after this massive collision."

Scientists have now begun searching for similar concentrations of fossil meteorites in 480-million-year-old sediments in other parts of the world.

"What we are doing is astronomy," Schmitz adds. "But instead of looking up at the stars, we are looking down into the Earth."

Maine's Proposed Mineral Park

Newry Would Welcome Mineral Collectors

by Steve Voynick

When it comes to minerals, virtually all state parks have one thing in common: collecting them is prohibited. In fact, only two state parks in the entire nation actually encourage the public to dig and to keep what they find. The best known is Crater of Diamonds State Park in Murfreesboro, Arkansas, where visitors can screen weathered kimberlite for diamonds. Westerners, however, may be more familiar with Rock Hound State Park near Deming, New Mexico, where visitors can search and dig in massive volcanic formations for jasper, chalcedony, and crystalline quartz.

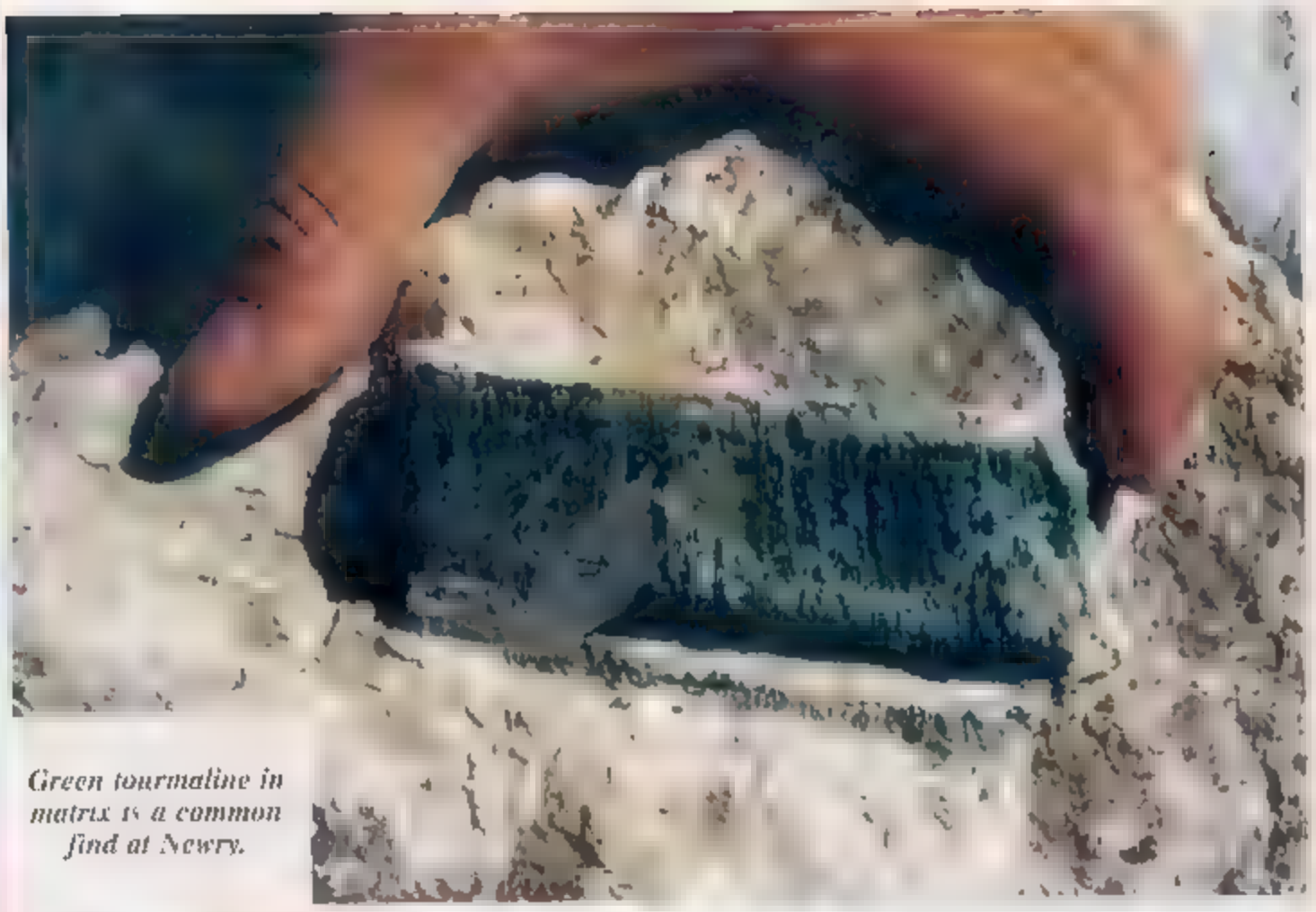
But if the Maine Geological Survey is successful, rockhounds may soon have access to a third state rockhounding park, Newry Mineral Park, near the town of Newry. It will be a scenic 100-acre site where mineral collectors can search through six quarries for a host of granite pegmatite minerals, including some of the finest gem tourmaline ever found in the United States.

Newry is located in Oxford County in western Maine roughly 75 highway miles north of the coastal city of Portland. Among Maine mineral collectors, though, "Newry" refers not to a town but to a cluster of a half dozen pegmatite quarries on a ridge of nearby Plumbago Mountain. For more than a century, Newry has attracted a host of pegmatite miners and mineral collectors.

"Mineral collecting is a very popular hobby in Maine," says Woodrow "Woody" Thompson, a physical geologist with the Maine Geological Survey and one of the driving forces behind the new park. "Unfortunately, many mineral collecting sites in Maine have been closed to the public because of encroaching development and other factors. But Maine now has the opportunity to acquire a tract of land at Newry with unusual historical, mining and mineralogical significance, and to open it to the public for mineral collecting and geological study."

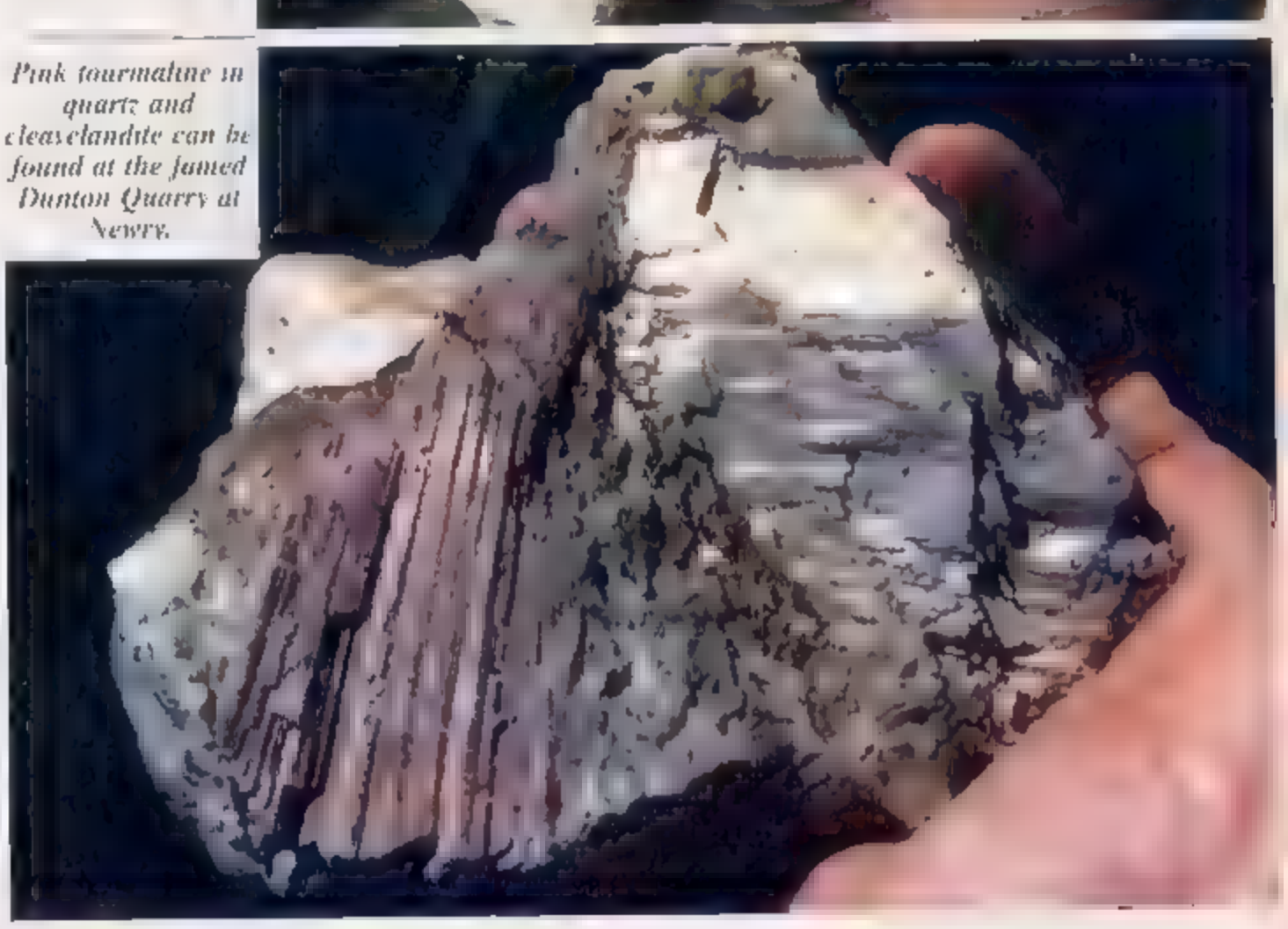
The land that Thompson and his colleagues, Maine State Geologist Robert Marvinney and former Maine Department of Conservation Commissioner Ronald Lavigne, have their eyes on is a 100-acre tract encompassing the Nevers, Bell, Martin, Crooker, Kinglet, and Dunton quarries.

The Dunton Quarry is familiar to everyone interested in U.S. gemstones. In 1972, it hosted one of the greatest tourmaline strikes ever made in the United States. A team of local gemstone miners opened pegmatite pockets that yielded almost a ton of tourmaline crystals, many of gem quality. The specimen that made the biggest head



Green tourmaline in matrix is a common find at Newry.

Beryl in quartz and cleavelandite is one of the more than 100 minerals identified at Newry.



Pink tourmaline in quartz and cleavelandite can be found at the famed Dunton Quarry at Newry.

line was named the "Jolly Green Giant." It was a huge, mostly gemmy, intensely colored green tourmaline that is now displayed at the National Museum of Natural History (Smithsonian Institution) in Washington, D.C.

With gemstones like that, it should be clear that the proposed Newry Mineral Park is not just any collecting site. As one of the nation's premier gemstone localities and with quarries that perfectly represent Maine's long history of pegmatite mining, Newry is fully worthy of the current $300,000 effort to preserve it for public use.

Newry is located in Maine's pegmatite belt, a trend of granite pegmatites that begins on the Maine-New Hampshire line west of Rangeley and extends nearly 100 miles southeast to Boothbay on the coast. Most of the pegmatites occur in Oxford County near the towns of Rumford and West Paris.

The term "pegmatite" generally refers to any coarse-grained igneous rock. A secondary definition, and one that certainly describes many Maine pegmatites, is a section of igneous rock characterized by extraordinarily large crystals and a concentration of minerals containing rare or unusual elements.

Most magmatic intrusions solidify relatively quickly, "freezing" into fine-grained, granitic rocks. Their primary mineral components—microcline feldspar, quartz, and muscovite and biotite mica—occur as evenly dispersed and uniformly small crystals.

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Maine's Proposed Mineral Park *from page 41*

For years, collectors have found the Newry quarries and dumps to be among the most productive collecting sites in Maine.

Pegmatites, however, form from the very slow cooling of granitic magmas. Most granite pegmatites contain large well-developed crystals of feldspar, mica, and white quartz. But as large magmatic masses solidify, isolated pockets of residual magma sometimes retain heat. Residual magmas, which are often enriched with such elements as beryllium, lithium and phosphorus, sometimes cool so slowly that they solidify on a fractional, or mineral by mineral basis. The result can be pegmatites with spectacular pockets of large, well developed crystals of rare minerals and gemstones such as beryl, the smoky and amethyst varieties of quartz, and tourmaline.

Maine's pegmatites are generally pod shaped and horizontally aligned. They vary in length from only a few feet to nearly a half mile and have a broad range of crystalline textures. Some are moderately coarse grained, while others are extremely coarse, with 5 foot "books" of mica crystals and common beryl and feldspar crystals as long as 20 feet.

When the last of the Pleistocene ice sheets receded from Maine some 15,000 years ago, they scoured away overlying sediments to expose the pegmatite-laced granite bedrock. Some pegmatites eroded away completely, while others were exposed to await eventual discovery. Maine settlers in the 1700s probably found gemstones scattered in the surface alluvium as float, that is, loose crystals from eroded pegmatites.

By 1800, miners were working Maine pegmatites for mica, seeking the translucent, sheetlike crystals for use as window and oven "glass." In the 1880s, feldspar, which is used to manufacture mild abrasives and ceramics, surpassed mica as Maine's most commercially important pegmatite mineral. Later, in the 1930s, Maine's pegmatite miners turned to beryl, valuable for its beryllium content, and to columbite-tantalite, a source of the rare-earth metals niobium and tantalum.

The first recorded discovery of Maine gemstones was made in 1820, when local farmers found tourmaline at Mount Mica near the town of West Paris. Mica and feldspar miners recovered tourmaline as a profitable byproduct whenever possible. By the 1880s, local and Boston-area gem markets were selling growing amounts of Maine tourmaline gems.

Miners discovered tourmaline at Newry in 1898, and commercial mining began four years later. Some Newry crystals exhibited a pink core surrounded by an outer green "rind" which local collectors named 'watermelon' tourmaline. Unfortunately, though, most of the tourmaline was opaque, translucent, or at best only semitransparent. Rubellite, the popular pink tourmaline variety, was scarce. Nevertheless, enough gem-quality material was recovered to supply two small local gem shops.

The biggest problem at Newry was the lack of pockets filled with free-growing crystals. Instead, Newry tourmaline almost always occurred in a tough feldspar matrix from which extraction of intact crystals was difficult.

The initial phase of tourmaline mining lasted just two years. Even though the output of gem-quality tourmaline was disappointing, mineralogists found a surprising mineralogical diversity at Newry, identifying 51 different minerals. The primary minerals at Newry are quartz, muscovite and cleavelandite. The last is a variety of albite, the sodium-rich end member of the plagioclase feldspar series, which often forms foot-long, bladed white crystals. Other minerals are spodumene, or lithium aluminum silicate; autunite, a hydrated calcium uranium phosphate; columbite-tantalite, a complex iron manganese niobium tantalum oxide; and lepidolite, a potassium aluminum lithium silicate mica. Unlike many other Oxford County pegmatites, those at Newry contained little beryl. Interestingly, some of the few beryl crystals found at Newry have a color and transparency similar to that of emerald.

Mining at Newry resumed in 1926, this time for pollucite, a hydrated cesium aluminum silicate. The General Electric Co. had contracted with local miners to buy pollucite for its contained cesium, which it used in the manufacture of radio tubes and photoelectric cells.

In the early 1930s, miners worked the Newry pegmatites for feldspar. During World War II, miners again went after

feldspar, as well as spodumene, beryl, amblygonite (aluminum sodium lithium fluorophosphate), and small, imperfect sheets of scrap grade mica.

During the intermittent mining ventures of the 1920s, '30s, and '40s, mineralogists continued to identify new minerals, such as herderite, or calcium beryllium fluorophosphate, beryllonite, a rare beryllium phosphate, and eosphorite, a hydrated aluminum-manganese phosphate.

In 1949, the discovery of a rare, intensely pink rose quartz interested Harvard University's Mineralogical Museum enough to send several specimen-collecting expeditions to Newry. During the 1950s Newry prospectors sought beryl and uranium. Miners returned a decade later, this time to recover spodumene, sometimes in 10-foot-long opaque, light-green crystals, along with foot-long columbite crystals.

Although the Newry pegmatites had commercially yielded a number of minerals, they had failed to fulfill their original promise of becoming a source of gem tourmaline. But in 1967, a mineral collector discovered the first pocket containing free-growing tourmaline crystals. Transparent and gemmy, these tourmalines were the best that Newry had ever produced—and they only whetted appetites for things to come.

In 1972, three experienced collectors, Dale Sweatt, Jim Young, and George Hartman, made a concerted effort to discover new pockets in the Dunton Quarry. Digging their way through 8 feet of tailings left behind by the pollucite miners of the 1930s, they discovered a small pocket with some gemmy tourmaline. Then they found other small pockets containing lepidolite, which at Newry can indicate the presence of tourmaline. As the prospect of finding tourmaline looked more encouraging, they were joined by two expert Maine pegmatite men, Frank Perham and Dean McCrillis.

Because large-scale, mechanical digging into the quarry wall would constitute mining, the team had to apply for a lease from the landowner, International Paper Co. The time and expense to obtain the lease proved well justified when mechanical excavation uncovered a series of small pockets with steadily improving grades of tourmaline in intense raspberry and grass green colors.

Days later, the miners hit the mother lode—a series of progressively larger, connected pockets that natural collapse had filled with a jumble of albite and tourmaline crystals. Unable to blast for fear of shattering the tourmaline, miners worked in the cold, wet, cramped pockets with only hammers and chisels. After penetrating 13 feet into the pegmatite, they began recovering 100 pounds of tourmaline every day. The biggest pocket was 6 feet wide, 7 feet high, and 20 feet long. In his journal, McCrillis wrote of one pocket: "It is too beautiful to describe. There are pilars of purple lepidolite with very crystaline white albite piles between them. Protruding from the albite are tourmaline crystals of every size and color."

Among these crystals was the famed Jolly Green Giant, a phenomenal, mostly gemmy, intensely green, terminated elbaite tourmaline crystal frozen into a white albite matrix. The tourmaline crystal measured 13 inches long and 4.5 inches in diameter.

In just two weeks the miners took out 1,700 pounds of tourmaline crystals that averaged 1.5 inches diameter. A surprisingly high 12 percent of the total recovery was gem quality. Most was raspberry-colored rubellite. The largest rubellite gem weighed more than 60 carats and was virtually flawless. The largest green tourmaline gem weighed 45 carats. Among the bicolored gems was a spectacular 44.7 carat octagon that was divided evenly in color between grass green and raspberry red.

Further exploration of the Dunton Quarry in 1973 and '74 revealed no new pockets. Although the landowner then closed the site, collectors continued to search the dumps for specimens. In 1986, local mineral dealer Joe Martin Jr. leased the property and opened it to collectors on a fee basis. When the lease expired in the mid-1990s, the landowner again closed the site, this time for good. By then, mineralogists had identified more than 100 Newry minerals.

In 2001, Thompson, Marvinney, and Lavagnino came up with the idea of acquiring the historic property and turning it into a park for mineral collectors. They approached the landowner, the Hancock Timber Resource Group, and International Paper Corp., which owns the mineral rights, and found the companies receptive to selling. They also figured that about $300,000 would be needed to acquire the land and mineral rights and open the site to public use. Work on the project began in earnest after Land for Maine's Future, a branch of the Maine State Planning Office, pledged $50,000 to the Newry Mineral Park fund.

"We envision more than just a site for mineral collectors," Thompson says. "The Newry Mineral Park would be a great outdoor laboratory for earth science classes, geology field trips, and for the educational community in general. It would also serve those interested in hiking and other types of outdoor recreation."

Besides the $50,000 pledge from Land for Maine's Future, an additional $20,000 has already been contributed, mostly by individuals, including many rockhounds.

"Every dollar counts," Thompson emphasizes, "and bolsters our chance of obtaining large grants. Some conservation-oriented grant organizations may be concerned that mineral collecting, by its nature, will disturb land. But this is not virgin land. It's already been disturbed by mining for a century."

The Newry Mineral Park will be owned by the state of Maine and supervised by the Maine Department of Conservation's Bureau of Parks and Lands. Partners in the project include the Maine Mineral Symposium Association, the Federation of Maine Mineral and Gem Clubs, and the Threshold to Maine Resource Conservation and Development Commission.

The Maine Geological Survey has already appointed a steering committee to discuss a park management plan. Currently, the committee is leaning toward free park admission, allowing collectors to keep all they find, and limiting digging to hand tools only. The park would be open only from morning to evening, a rule that would prevent good collecting sites from being monopolized by folks who otherwise might camp all night at a good spot just to hold it. And what would happen if a collector did find a pocket full of valuable, gemmy tourmaline? Thompson says that any crystals would be his to keep.

Exactly when the Newry Mineral Park will open depends entirely upon one thing: funding.

"If someone contributed the remaining funding today, then we'd start work to open the park right now," says Thompson. "Or it might take a year or two. But we've started the project, and we're going to see it through to completion."

Thompson points out that all funds raised for the park go into an account separate from Maine's general fund. The park funds can be used for no other purpose and, if the project should not go through, the funds will be returned to donors.

Hopefully, that won't be necessary, because this project deserves to succeed, both on its own merits and as a model for similar projects in other states. Newry is one of Maine's greatest mineral-collecting sites and a place of considerable natural beauty. The quarries are located at an elevation of 1,500 feet and afford a wonderful view of the Ellis River Valley and 2,200-foot-high White Cap Mountain to the northeast.

The Maine Geological Survey is gladly accepting donations for the establishment of the Newry Mineral Park from mineral collectors, gem and mineral clubs, conservation organizations, and individuals interested in having a special piece of land preserved for future public use. Checks can be made payable to "Newry Mineral Park" and sent to Newry Mineral Park, c/o Maine Geological Survey, 22 State House Station, Augusta, ME 04333-0022. Contributions are tax-deductible and all will be acknowledged. Donors contributing more than $100 will receive an attractive recognition certificate.

For further information on Maine's Newry Mineral Park, call (207)287-7178, or visit the Web site at www.state.me.us/doc/nrimc/mgs/mineolec/newry.htm.

LAPIDARY LORE and MORE

by June Culp Zeitner

Field Trip Pioneers

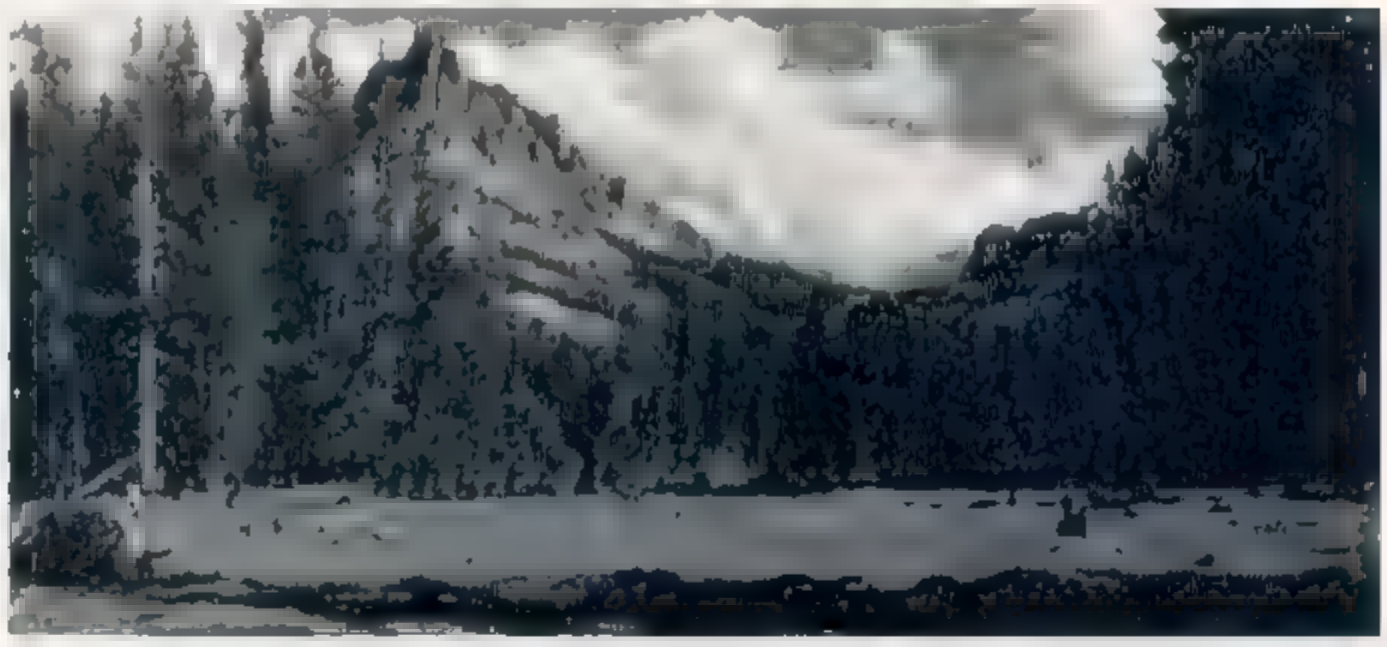
Some time ago at a show, I went to lunch with a group of rockhounds from several states. The subject, as usual, turned to field trips. A lady from Colorado said she would never go to her favorite agate site again because there were too many ruts and washouts in the dirt road. A man replied that he had given up his favorite location because there were too many gates to open and close. This was topped by a family who agreed that their best place was so remote it was too much work to pack water, food, and other supplies to make the trip, and besides, last time they went they saw two rattlesnakes.

Immediately I thought of pioneer rockhounds who daily faced more problems and dangers than most of us do in a lifetime. A perfect example is T.R. Shimmin, the head of a 10-rockhound family. He was the grandfather of my friend Bob Wilson, whose mother, Maude, was one of eight children who became life-long rockhounds because of two incredible trips in the early 20th century. Bob, a third-generation rockhound, was chairman of one of the largest field trips ever, which brought almost 3,000 people to headquarter in a town of 900 for a one-week "rock" hunt. His wife, Maxine, is Curator of the National Rockhound and Lapidary Hall of Fame, as well as a collector and writer.

T.R., a geologist and avid rockhound, moved from Wisconsin to North Dakota in 1882 to homestead near the town of Ellendale. T.R. had been a member of the U.S. Geological Survey Expedition and then Ellendale, in glaciated country, did not have much to interest a geologist, so in 1903 he decided to take his family to South Dakota, a young state already known for fossils and minerals, where the gold rush was still in full swing.

He outfitted two covered wagons and took along his camera and processing lab. He chose eight fine horses and assured his anxious dogs that they could go along. Then he found a "hired girl" to help his wife, Mary, take care of the children, meals, washing, and "woman's work." They planned to live on wild game and fish, and they took along plenty of salt and some kegs in order to salt down fish they could not eat fresh.

They found their first fossils along the Missouri River shortly after leaving North Dakota. The fossils were marine invertebrates, cephalopods, nautiloids and pelecypods. Since T.R. mentioned that calcite crystals occurred with the fossils, the Pierre shale septarian concretions must have been his source. He also mentioned the gumbo soil near the river as being so hard that he had great difficulty driving in his sharp steel tent pins.



Pioneer rockhound T.R. Shimmins found campsites like this in Wyoming.

When the family arrived in what is now Badlands National Park, they were awed by nature's strangest sculptures. Fossils were everywhere, some still entombed and hardly visible on the surface, and many lying on the ground in broken heaps. In spite of many rattlesnakes, dangerous terrain, insects, and bad water, the family and the hired girl patiently dug out many fossils in excellent condition, which they shipped to the Smithsonian whenever they came to a town.

In scenic Spearfish Canyon, the family found fossil corals, brachiopods and gastropods. In Meade County, they found a huge petrified forest. They panned for gold in a number of creeks, but got only gold dust and a few flakes. In the southern Black Hills they found quartz, feldspar, black tourmaline, apatite, cassiterite, muscovite, beryl, spodumene, and calcite, to name a few. They also explored numerous caves with homemade torches.

Once, at a particularly remote campsite, Indians stampeded the horses. It took many hours to round them up and several were wounded. Thunderstorms and hail were common. Roads, when there were any, were poor to mediocre.

On the long journey home, the children collected wonderfully preserved sequoia cones. Even the little ones were proud, experienced collectors. Many tons of fine specimens had been shipped to the Smithsonian, among them agates, crystals, fossil plants, seeds and cones, an Eocene horse, an Oligocene oreodont, a fossil tapir, and a rhinoceros.

Although they loved the magnificent scenery and the abundance of minerals and fossils in South Dakota, home never looked so good to the Shimmins. They had lived on wild game and fish and occasional wild berries so long that eggs and beef and particularly milk were gourmet treats. Mary was glad to have water that didn't have to be boiled.

Not two years later, T.R. announced to his family that in late May they would be starting for Yellowstone National Park. Ten people, two wagons, and eight horses set off on May 22, 1905. The oldest child, Ellen, was 13 at that time and undertook the job of helping with the journal. Maude was 11 and remembered details of the Yellowstone trip as well as the South Dakota trip. (I knew Maude when she lived in Mardo, South Dakota. She used to come to our museum, where she recognized mineral and fossil examples of specimens like those she found when she was only 9.)

Due to events suffered during the first trip, T.R. had new extra-heavy brakes installed in the wagons. He also had the wagons enlarged so springs and mattresses could be put inside. The large tent was for cooking, and this time there was a big camp stove complete with oven. Even in late May, hard frosts came every night.

Each day they saw many rattlesnakes and wolves, but that didn't stop them from looking for fossils, to the delight of the children. Although it was a dry spring, the mosquitoes blackened the air. When they saw many dead cattle in the Cannonball River, they knew to be especially careful about boiling all water. Soon, a big hailstorm left several inches of huge hailstones on the ground. The hailstones were quickly gathered to fill the water barrel. According to T.R., it was the best water they had for several days.

Cold, wet weather resulted in a hard cold for Mary and the baby. The family occasionally saw wolves, antelope, deer, prairie dogs, beavers, and wildcats. When they crossed into the northwest corner of South Dakota, the roads across the buttes were so steep and slippery that they had to use all the horses on each wagon.

One day, T.R. forbade the thirsty children from drinking the cold, clear water from an inviting spring. Just then, a cowboy rode up to warn T.R. that there was arsenic in the water. Ellen and Maude asked T.R. how he had known the water was poisoned. He replied, "There are no animal tracks around the spring."

As the elevation gradually rose to over 7,000 feet, the horses began to tire much more quickly, so fewer miles could be made each day. In Montana, they found agate, green jasper (bloodstone?), and excellent petrified wood, as well as small, colorful stones in a creek (maybe sapphires?).

It took them two months to reach Yellowstone. At one point, they stopped to catch some trout. The nights were still around 30 degrees, so after supper they hung the rest of the fish on the back of a wagon, planning on a fried trout breakfast. The next morning the bag o' fish was gone. Bear tracks revealed the reason.

T.R. noticed a sign marked "Glass Mountain" and saw that the road was made of crushed obsidian. Unbelievable fossil forests marked Specimen Ridge. Twelve petrified forests stood one on top of another. Huge logs were brightly colored. The family agreed the whole area was "like a giant museum." T.R. spent days taking and developing pictures of the wonders of Yellowstone. The children were amazed by the geysers and amused by the bubbling mud pots.

On the way home, a brake broke on the lead wagon during a hazardous trip down a steep hill. Some days, crossing the Big Horn Mountains, they were able to make only one half mile. A wagon tipped over in a deep washout and many supplies went flying down the mountain, including the treasured flour. The climbs were so dangerous they had to take the wagons apart and, using horses and ropes, pull each piece to the top to be reassembled when it was safe. A geological marker at the top of one mountain read 8,000 feet. T.R. was thankful for his 1,000 feet of heavy rope and glad to be out of the mountains.

Later, they entered an area now centered by Lemmon, South Dakota, where they encountered a forest of silicified trees, with some logs as long as 75 feet. Near Butte, they collected belemnites 12 inches in length.

As the two wagons approached North Dakota in September, it snowed hard, and the next day the melting snow made the slippery gumbo trail almost impassible. On the Missouri bluffs, they gathered many geodes of all colors and sizes.

On Sept. 24, four months and two days since starting their Yellowstone adventure, they arrived home. They were all well. They had found wonderful specimens for the Smithsonian and an unnamed East Coast museum. They had braved countless hazards and taken dangerous risks. They came through adversity with sighs and smiles. Was this their last trip? No! Determined rockhound pioneers stopped at nothing.

We have things so easy today. Although I pursued the rockhound trails in 48 states, southern Canada, and most of Mexico for 30 straight years, I don't think I could have tolerated what the Shummin family did. But don't I wish that I had seen untouched rock beds, mineral and fossil deposits, and pristine scenery like they did.

Dawson and THE KLONDIKE

White Channel Gravels Prove a Surprise Source of Gold

by Roger McPherson

While the excitement and bustle of early Dawson, Yukon Territory and the Klondike gold rush are now a distant memory, the mystery of the gold's origin and its distribution in the White Channel gravels are worthy topics to revisit. Though other gold rushes had more gold and more people, the Klondike has powerful lessons in success and failure, geology and geomorphism, and the inevitable progression from small miners to giant dredges and back again to small operations.

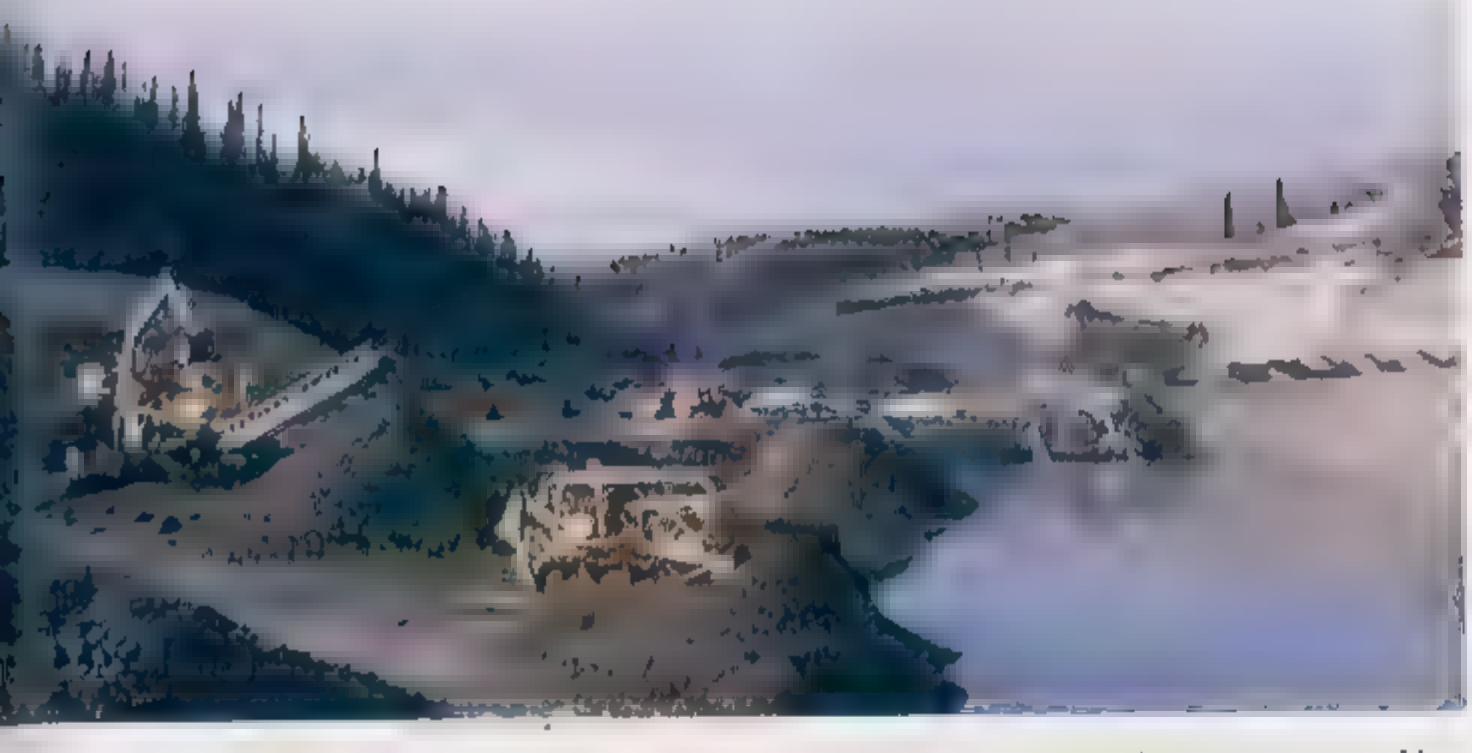
This 800-square mile area between the Klondike River on the north, the Indian River on the south, and the Yukon on the west has King Solomon Dome near its center. Radiating off King Solomon Dome are Hunker, Gold Bottom, Adgold, Dominion, Gold Run, Sulphur, Quartz, and upper Bonanza creeks. Eldorado Creek, a tributary of Bonanza, doesn't quite reach to the dome. These creeks and the Klondike River produced over 10 million ounces of gold.

"We tried on Sulphur and we heard about Last Chance Creek just off Hunker," said Ricci Mills, owner of active claims along with Bob Cattermole. She had been mining in the Klondike for 10 years. "Here, where we're mining, it's fine gold, a nice gold color. They're trying to find corners where the dredges missed. They often dig up the old-timers' shovels and pails."

At the entrance to their operation, a sign promised gold panning. "The tour buses just see the stops and go on," she remarked. "The tourists that drive to Dawson in their own cars or campers, they come in here."

As early as the 1880s, men were prospecting in the area, but when Anna "Mother" DeGrat and her party went by in a boat in 1893, the Klondike was still undiscovered. "Then, it was a wilderness," DeGrat wrote in *Pioneering on the Yukon, 1892-1917* (Roger S. Brown, editor, Archon Books, Hamden, CT, 1992). "As we rowed along I said to the men, 'Why don't you stop and prospect along here? This country looks good to me.' They said, 'Awh, we haven't time. We want to get where there is gold'—meaning Circle City, which was the newest camp at that time."

The Canadian prospector Robert Henderson and a small party first began prospecting on the Indian River and Quartz Creek in 1894. The Indian River enters the Yukon 22 miles upstream of Dawson, and it becomes Dominion Creek as it circles north and west toward King Solomon Dome. Dominion's productive tributaries Quartz, Sulphur, and Gold Run creeks also head toward the Dome. The following year, Henderson went up Quartz Creek, over the Dome, and into Gold Bottom Creek, a tributary of Hunker Creek that flows northwest into the Klondike River. Here, he and his four partners set up a summer camp and cut into the gravels to bedrock, finding enough gold to justify a discovery claim. However, his subsequent decisions would leave him frustrated and penniless.



Martin Knutson's placer operation on Last Chance Creek uses heavy equipment to get at gold-bearing ground buried under a White Channel gravel fan. This virgin ground was too deep for the dredges to work. (Photos by the author)

California-born George Carmack first came into the Yukon by packing over Chilcoot Pass in 1885 with a prospecting party. After whipsawing lumber and building a boat, they checked the creeks around Lake Bennet and Tagish Lake. He wrote to his sister Hannah Rosella in California about his trip: "There is a big gold field in the Yukon, and I want my share of it and am going to have it if the Lord wills it." On this first trip into the backcountry, Carmack brought back 2 ounces of gold. The next summer, he hired out as a packer, teaming up with Skookum Jim and Tagish Charley, two Indians from the Interior, and that winter he journeyed to their village on Tagish Lake and stayed.

His momentous find would come after 10 years of packing for others, trapping, prospecting and roaming the Yukon River with Tagish Charlie, Skookum Jim and Jim's sister Kate, who became Carmack's common-law wife. In 1896, to get money for the approaching winter, Carmack enlisted his two Indian companions in a plan to cut timber up the Klondike River and float it down to the town of Forty Mile. They would prospect as part of the trip. Bushwhacking their way up the first tributary of the Klondike, Rabbit Creek (which miners later renamed Bonanza), they found fine gold. They continued to work their way farther upstream in search of coarser pieces.

Carmack and the two Indians hiked over King Solomon Dome and visited Henderson on Gold Bottom Creek, showing his party the fine gold they had found on Bonanza. Henderson wasn't impressed, and he insisted Carmack stake a claim below his. However, he didn't want the two Indians staking on his creek. When the Indians and Carmack hiked back to Bonanza, Carmack promised to let Henderson know how rich the ground was – but he didn't.

After leaving Henderson's camp, Carmack investigated along a small tributary of Bonanza, later known as Eldorado Creek. Half a mile below the fork where Eldorado joined Bonanza, later the site of the town of Grand Forks, Carmack spotted bedrock in the streambed. Soon he picked up a nugget the size of a wrinkled dime. His first pan had more than ½ ounce of gold, a $5 pan in those days.

On Aug. 17, 1896, Carmack marked off 500 feet along the creek for the discovery claim, and in addition, Number One Below Skookum Jim staked Number One Above, and Number Two Below was Tagish Charlie's. They set off for the fish camp at the mouth of the Klondike with a shotgun shell filled with gold. Using Carmack's letters and diary, James Albert Johnson tells the complete story in *Carmack of the Klondike* (Epicenter Press, Seattle, WA, 1990).

Experienced prospectors maintained that the valley was too wide, the willows didn't lean in the right direction, and the water tasted wrong. They also felt the discovery was too far upriver, that it was on the wrong side of the Yukon River, and that no one ever found gold in such moose pasture. Many early stampeders sold their claims in the belief that the ground wasn't rich. However, by the end of August 1896, all of Bonanza Creek was staked.

"Your standard creek or placer claim would be 500 feet from Post One to Post Two," mining recorder Kathryn Perry told me over the counter of her Dawson City office. "And that would be along the creek, extending 1,000 feet out on either side." She pulled out a piece of paper and drew a diagram of the types of claims. "Now that there's so little ground open on the creeks, people are going to bench claims. The only problem with that is there's so little access to water.

continued on next page

White Channel gravels were found in the hills along Eldorado and Bonanza creeks. Many of these hills have been washed into the river valleys as miners processed the lower-grade areas.

Dawson and the Klondike *from page 61*

"The third type of claim is a discovery or co-discovery claim," Perry continued. "It can be staked on a creek that has never been staked before. We rarely get discovery claims these days because so many of the creeks in the district have been previously staked.

"Prior to staking a claim, the prospector should visit this office to review the claim sheets," she explained. "We pull out a claim sheet to see if the ground is open. If the prospector finds open ground in an area he is interested in, he would then go out and stake the ground. The prospector fills out an application that states he's set his posts, and swears that the information is true and accurate to the best of his knowledge. As long as he's within his traveling time and on open ground, there's no reason the claim won't be granted to him. The traveling time is determined by how far the claim is from the office.

"You can also do recreational panning on open ground," Perry added. "But it would be advisable to come here first and check if it's open ground. Even if their intention is not to stake a claim, people often get interested once they find out how cheap it is. There's a $10 recording fee, a yearly fee of $10 to renew, and yearly $200 worth of assessment work—digging one shaft or moving gravel. If you're doing grass roots mining—hand shoveling and don't need water—you don't need a mining land use permit."

Open all winter, the recorder's office has claim maps for sale, and it maintains a Web site with information on mining requirements, maps, legislation, and general information. Claim sheets are found at www.gov.yk.ca/depts/dgs/min.ngrecorders or by writing to Mining Recorder, Box 249, Dawson City, YT Y0B 1G0.

Henderson is credited with being the co-discoverer of the Klondike, but his claims on Gold Bottom, Hunker, and Bear creeks made others rich. Weeks after Carmack's find on Bonanza, a few prospectors encountered Henderson still working on Gold Bottom, and they told him of the furious activity on the other side of King Solomon Dome. He rushed to the recorder's office at Forty Mile to find that the new Klondike mining district now allowed only one claim per man rather than one claim per creek. He decided to record his claim on Hunker Creek, eventually selling it for $3,000. This one claim would bring its future owners more than $500,000. On his way out of Alaska on an ocean steamer, Henderson's remaining gold was stolen. He continued to prospect for the rest of his life, but he never found another bonanza.

Pierre Berton grew up in Dawson and worked in Klondike mining camps. He wrote *The Klondike Fever* (Alfred A. Knopf, NY, 1975), a detailed account of this famous gold rush. Berton described how four men with claims on Bonanza Creek were drawn to the small tributary called Bonanza Pup, "the richest creek in the world," where Carmack's panning hadn't found anything. Their first pan yielded more than $6 in gold.

Others soon noticed the muddy creek water coming out of Eldorado, indicating new claims were being worked. Berton documents the sudden rush of men to claim a piece of this creek. "Nobody then knew, of course, that this was the richest placer creek in the world, that almost every claim from One to Forty was worth at least half a million, that some were worth three times that amount, and that a quarter of a century later dredges would still be taking gold from the worked over graves." Because the White Channel came down alongside Eldorado Creek, the upper portion of Bonanza didn't have the great riches that were found below their forks.

Word of the great discovery hit Seattle and San Francisco in July 1897, when the steamers arrived with miners carrying gold nuggets in suitcases, sacks and rugs. Alaskans in Juneau and along the Yukon River were already streaming toward Dawson as the news spread throughout the world. A movement took shape from all corners of the United States, based on the optimistic belief that everyone had a chance to make a fortune if they could just get there. By the summer of 1898, creeks 85 miles from Dawson had been staked.

A major discovery still waited for men to stumble upon its secret. During the summer of 1897, white gravel was exposed by miners dragging winter wood down the slopes from benchland above Bonanza Creek. All the creeks and gulches had been staked, but the white gravel in the hills and high benches wasn't seen as part of the old riverbed. This White Channel, or "quartz drift white wash," ran along the western rim of Eldorado Creek, down Bonanza, and across the main valley of the Klondike River.

Two prospectors had seen similar high benches during the rush to Cariboo, British Columbia, and they dug into the gravels on French Hill just up Eldorado Creek from the Forks. Others tested the hills of Bonanza above Carmack's claim, sinking shafts through the white gravels. Miners saw the newcomers working on the hillside and named it Cheechako Hill. They couldn't believe gold could be deposited so high in the hills. People new to the diggings didn't have any preconceived ideas as to where gold could be found, and they staked the hills. By the summer of 1898, the Rev. George Pringle, minister of the Church of England on Gold Bottom Creek, declared, "The only benches not staked are those in my log church."

Robert Boyle summarized the four stages of Klondike gold deposition in *The Geochemistry of gold and its deposits* (Geological Survey of Canada, Bulletin 280, 1979): "(1) primary concentration in quartz veins and other bodies, (2) sec-

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Dredge No. 4 on Bonanza Creek is the largest wooden-hulled dredge in North America. It began processing gravels in 1912 and it worked until 1966. Parks Canada opens it for tours in the summer.

ondary concentration in the oxidized zones of the quartz veins and other auriferous bodies (3) tertiary concentration in the plateaus of the high level White Channel gravels, and (4) quaternary concentration in the low-level gulch, creek, and stream gravels"

The Canadian geologist R G McConnell classified the different types of Klondike gravels in several early reports (1900, 1905 and 1907) The youngest gravels, the low-level gravels, were the first ones worked by miners in the rivers, creeks and gulches. Higher up were small and irregular deposits of terrace gravels, remnants of former valley bottoms. The high-level gravels forming the hills, the oldest and the most important being the White Channel gravels, were overlain by thick layers of barren river gravels

Ideal conditions for placer gold deposition are found in the Klondike Numerous gold-bearing quartz veins in the mica schist were slowly eroded out as the schist decomposed over a long period of time Winding streams with slack currents built up deep gravels in wide, flat valleys Throughout the history of the White Channel rivers, the gold was worked and reworked through a 100- to 150-foot accumulation of gravel and concentrated into the bottom 6 feet of gravel above bedrock In more recent time, the land was uplifted and new creeks began cutting steep-sided valleys and gulches through the White Channel gravels and slicing deep into the schist bedrock, in some places as much as 600 feet The uplift was not as great to the east of King Solomon Dome, where White Channel gravels still underlie parts of the valleys of Dominion, Sulphur, Gold Run, and Quartz creeks

Miners traced the old course of the richest White Channel river down Eldorado and Bonanza creeks by its trail of coarse gold Where the more recent creeks cut the old river, the creek bottom opposite the destroyed portion of the ancient river was enriched If the creek gravels were lean, the fronting hillsides would be productive These hillside areas were first drift mined with tunnels, and then washed down (hydraulicked) with high pressure jets of water The most famous of the White Channel gravels were found on French Hill on Eldorado above Grand Forks, and on Bunker, Gold, Cheechako, Adams, Magnet, American, Orofino, Monte Cristo, King Solomon, and Boulder hills on Bonanza Creek

Prospector Edward Lung's friend Andy described these famous hills to him in painful detail in *Black Sand and Gold* (Binfords & Mort, Portland, OR, 1956, "'Well, Ed,' continued Andy, 'this new Lode seems to run like a great chain of gold on a series of hills each one broken a little or separated from the other by a small gulch between In other words, each hill stands as a separate unit, yet seems to belong to the whole Now, there's Gold Hill! It stands right at the Forks of the Bonanza and Eldorado Ed, they're getting $400 to $500 to the pan . and even more It's the very richest!'"

Hunker Creek and its tributary Gold Bottom also had evidence of a White Channel in Whisky, Delhi, Temperance, Nugget, Paradise, Preido, Dago, and Australia hills, although the gold values were lower A rough gravel road loops around this area, following up Hunker Creek, crossing over the divide near the head of Gold Bottom Creek on King Solomon Dome, and running down Upper Bonanza and Bonanza Creek following an old railroad grade. Signs along the road identify some of the famous hills and the location of Carmack's discovery claim on Bonanza Creek A few hundred feet above Carmack's discovery claim, a fraction just 86 feet at its widest was found after the claims were surveyed, and it paid out $500,000 when gold was $20 an ounce!

Many small, gold-bearing veins near the heads of the creeks and gulches have been identified The fineness (,000 fine being pure gold, or 24 karat) of the placer gold from near the headwaters of various creeks has been correlated to different low fineness and high fineness source areas Silver was the most common alloy, but copper and mercury were also present in some gold nuggets These alloys would reduce the gold fineness, and they would create a trace element signature similar to that of their lode source

In the Bonanza Eldorado area, the gold is mostly 750 to 850 fine, with no mercury. This is similar to gold veins such as the Lone Star Mine, found in 1899 on the divide between Bonanza and Eldorado creeks. Its numerous quartz veins in a shear zone were trenched and followed by tunneling A small stamp mill operated for two years, producing the only lode gold from the Klondike. Octahedral gold particles were found in the mine and in the downstream placers. Based on its composition and location, the coarse and angular gold on Bonanza and Eldorado creek placers evidently came from this general area

Exploration has identified about 20 gold quartz veins in the Klondike containing secondary barite and pyrite that cross-cut the foliation of the schist. Quartz veins concordant with the schist do not carry gold The Mitchell deposit on the divide between Gold Bottom and Hunker creeks north of King Solomon Dome was located on a gold-quartz vein with free gold The vein was traced for 3,000 feet, but the foot wide vein on the surface pinched out at 80-foot depth Typically, Klondike veins are limited in extent and do not support hardrock mining operations.

Geologists have concluded that the Klondike placer gold probably came from numerous quartz veins containing very high-grade zones that were completely or

One of Marty Knutson's excavators digs bedrock from an open pit in a narrow valley off Hunker Creek. Bedrock in the creek acted as a natural riffle and trapped nuggets.

partially eroded over a long period of time Many of these quartz veins may still be undiscovered because of the mantle of slope rubble, moss, and high bench gravels Geologists have several theories about where the vein gold came from and what mechanism drove it into the fractures in the schist Regional metamorphic processes fluids from a deeper magma, or deep circulation of surface waters are all possibilities A deep-seated gold reservoir may still exist under King Solomon Dome

The Nome rush of 1899 and the Fairbanks rush in 1902 03 reduced Dawson's population By the end of 1901, the city began cleaning up its dance halls and downtown Gambling was forbidden People abandoned their claims or sold out to A N C Treadgold's Yukon Consolidated Gold, a Guggenheim company The creeks and White Channel gravels had been worked and reworked More stability came when dredges began providing steady employment from 1905 until the early 1960s, but this meant that independent miners became laborers for the new companies

Mining concessions were granted that purported to focus only on the big streams, the lower end of big creeks, and up the hills above the 400 foot level where the "free miner" couldn't work the ground However, some of the 40 hydraulic leases or concessions were on the richest creeks Lewis Green's *The Gold Hustlers* (Alaska Northwest Publishing Co , Anchorage, AK, 1977) describes the battles between these "gigantic monopolies"

Joe Boyle worked on claim Number 13 Eldorado for wages, and he saw the potential in 1897 for large-scale operations on the Klondike River gravels. He applied for a mining concession from the Canadian government on eight miles of the river from the mouth of Hunker Creek to the Bonanza ferry After much political effort, he got 6 72 miles of the Klondike River and all of the Bear Creek watershed, a lean tributary of the Klondike These gravels were not economic for small operators to work, and being water saturated, they were ideal for dredging

"He loved a fight" his daughter said of Boyle "There were always lawsuits He had lawyers on retaining fees in the Klondike, in Vancouver, London, New York, Detroit, and Windsor" Boyle's company became the Canadian Klondyke Mining Co , although people usually called it Boyle's Concession because he controlled a tract of land covering 40 square miles He built Canadian Klondyke dredge No , in 1905 on the Klondike River flats opposite the mouth of Bear Creek It paid for itself in two months of work. Dredge No 2, the largest in the world, was built in 1910

Meanwhile, Treadgold bought numerous claims, and planned a 50-mile ditch for water and a power plant. With backing from the Guggenheims, he formed the Yukon Consolidated Gold Fields Co and the North West Hydraulic Mining Co By 1907, these companies were united as the Yukon Consolidated Gold Co. (YCGC) and it had seven dredges operating by ,908

The YCGC had five dredges on Bonanza Creek that received electric power from Boyle's North Fork power plant, in addition to his own two behemoths Using a six mile ditch ,8 feet wide at the bottom and covered with a roof of ice, Boyle generated hydroelectric power all winter long for the dredges and the city of Dawson in spite of the sub-zero temperatures. Boyle built dredges No 3 and No 4 in 1912, and No 4 worked until ,961 This huge dredge is on display eight miles up Bonanza Creek, with tours from the end of May through August

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Dawson and the Klondike *from page 65*

The YCGC eventually controlled all the dredges and Boyle's old headquarters at the mouth of Bear Creek, now a Parks Canada Historical Site that has tours in summer. Over a 30-year period, the Guggenheims moved their equipment to Alaska, Idaho, and the tin fields of Malaysia. By the 1960s, most of the dredges left in the Klondike had shifted their operations to creeks draining south and east of King Solomon Dome—three dredges were on Dominion Creek and two on Sulphur Creek before the YCGC ceased operations. The company had paid dividends from 1940 until 1965, but the history of the dredges is one of bankruptcies, broken promises, backroom deals, and endless litigation.

There was a decline in gold production after 1914 because World Wars I and II took many Canadian men, and the territorial government moved to Whitehorse in 1953. The old Territorial Administration Center was restored in 1986 and it houses the Dawson City Museum, with displays about the Klondike Kings. The S.S. Keno sternwheeler is on display on the bank of the Yukon, and part of the town is a historic park.

The Yukon Gold Panning Championship takes place on July 1 every year, along with a celebration of Canada Day. George Carmack's Aug. 17 discovery is commemorated in mid-August when the Yukon Order of Pioneers has a parade. And the Klondike Visitors Association maintains a public panning area at No. 6 above Discovery, 13 miles from Dawson City on the Bonanza Creek Road.

"I was logging in 1980 when I heard they still mined gold in Dawson City," lanky Marty Knutson said, his mustache not covering his big grin. "Here, you're your own boss. I maintain all the equipment. I do it all myself."

Around him, two large excavators were at work in a narrow valley off Hunker Creek. One dug several feet into dark bedrock in an open pit, while the other machine swung back and forth, feeding a vibrating screening plant and sluicebox. Oversize rocks came off a conveyer belt and fine sand and muddy water ran out of the sluice in a steady stream.

"They sliced off the white gravels from the hills and filled in this valley," Knutson explained. "We call this a tailings fan. They buried a virgin area. It was too deep for the dredges to work. What happens when the White Channel gravels fill a valley, they melt the ground, thaw the gravels after a hundred years or so. Then you don't have that ripping cost." He looked around at the smoothly running machinery. "We're a 100-cubic yard an-hour operation."

Writing in 1924 at the age of 85, Anna DeGrat echoed the feelings of many who had been to the Klondike. "The minerals that are buried in that country—it is hard to believe! If I were a young man, with no one dependent on me, I would certainly go back to that Yukon country and prospect, and make myself independently rich. Wherever you go in that country, there is gold—placer gold, or quartz gold. Those who know will tell you that the surface has only been scratched."

A one-man operation, the Last Chance Creek placer mine moves 100 cubic yards an hour.

Sapphires are mined from the ancient river gravel terraces of the Missouri River. (Photos by the author)

Montana Gemstones, Dinosaurs and Hospitality

Part 1: Sapphire Mining at Spokane Bar

by Kenneth H. Rohn

I was recently invited by Donnie Sexton, a representative of the state of Montana's travel promotion office, Travel Montana, to take a tour of Montana. Travel Montana was eager to promote the opportunities for rockhounding in the state and hoped that I would share my experiences with the readers of *Rock & Gem*. Naturally, I accepted the invitation.

When I received the first e-mail message from Donnie, spring snow still lingered in my yard here in Minnesota. Several messages and arrangements later, the trip was set. I was excited to say the least. Here was a rare opportunity to experience the great outdoors in two of Montana's six vacation regions, Gold West Country and Russell Country. I'd take part in mining sapphires, one of Montana's beautiful state gemstones (the other is Montana moss agate), and join a group for a hands-on dig for rare duckbill dinosaur fossil remains.

The trip would also entail spending my nights in several excellent hotels, one of which is brand new and opened in June of 2003, The Great Northern Best Western Hotel in Helena. The food was out of this world and the hospitality of my gracious lady escorts was tops. The areas we visited cover thousands of square miles of territory, yet are only a fraction of this magnificent state. Although I'd like to go into greater detail of this outstanding field trip, space does not allow it, so I'll give the highlights of my itinerary.

The trip began at Helena, the beautiful capital city of Montana. When I arrived at Helena via Northwest Airlines, Donnie was waiting. I was a day late, due to engine failure on my plane out of Duluth, Minnesota. Naturally, I missed my connections when I landed in the twin cities two hours late, so I had to spend the night in Minneapolis.

Sapphires clogged the riffles of prospectors' sluice boxes and were discarded by the bucketful in the 19th century.

The author holds up a gem-quality sapphire, freshly picked from the concentrates. (Donnie Sexton photo)

Donnie Sexton admires a beautiful blue sapphire mounted in a gold ring from the Gold Fever Rock Shop.

I landed at Helena during one of the hottest periods of the year for southwestern Montana. As a matter of fact, Helena had a record high of 105 degrees one day in mid-July while I was there.

I spent a restful night in Helena at the Wingate Inn. Next morning, Donnie and I set out for the Spokane Bar Sapphire Mine and Gold Fever Rock Shop to try our luck. The mine is a family operation owned by the Thompsons. Here you can buy buckets of concentrates, wash and screen your own dirt, and recover those magnificent gemstones on the work tables. If you prefer, you can actually dig your own material right out of the ground at one of the mine sites, screen out the waste material, and return to the office, where you'll wash and recover the sapphires. It's a strange phenomenon that I've experienced in the past. While you're actually digging and screening the concentrates, you will rarely see sapphires in the dirt.

It's approximately 10 miles to the Spokane Bar Sapphire Mine from Helena. To get there, take York Road to mile marker #8 and turn right on Hart Lane. Follow Hart Lane to Castles Road and turn left.

Sapphires were first discovered in Lewis & Clark County in 1865 during the height of the gold-producing era. They were found high and dry in ancient river gravel terraces—often as high as 200 feet above the Missouri River.

While he gave us a guided walking tour of the area, Cass Thompson (soon to receive his masters degree in gemology) told us a most interesting story about sapphires. During the gold rush days of the 19th century, the miners were having trouble trying to keep innumerable heavy, attractive, small stones from plugging the riffles in their sluice boxes. The miners were losing precious gold and had to constantly remove those pesky stones. Three of the miners became curious and sent a quantity of stones to a gemologist in England, who identified them as sapphires, but said they were of no value. How wrong can anyone be? The word soon got around and the miners lost interest. They either threw the nuisance stones onto the waste piles as soon as they accumulated, or tossed them into a bucket for future examination, and they were soon forgotten.

During that frenzied period of gold mining, the miners actually tunneled into the high gravel terraces along the Missouri River in their search for those elusive gold pockets. (Although the banks today are very high above the existing water level, in prehistoric times, the river was much wider and deeper.) Well, when the gold petered out, the miners went away in search of other productive areas, leaving buckets of sapphires behind, stashed in some of those drifts. Others were left on the surface in or near waste ore piles, overgrown with a tangle of grass and underbrush and hidden from view for 140 years. After all, why bother to carry an extra burden along?

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Montana Gemstones, Dinosaurs and Hospitality *from page 89*

A find was made recently, so Donnie and I were told, by one lucky modern-day prospector who happened upon one of those buckets of sapphires. The net worth of such a find is, of course, astronomical; indeed a ransom to compete with King Solomon's mine.

Corundum has a specific gravity of anywhere from 3.96 to 4.01 and often a bit higher. This makes it a good deal heavier than the surrounding material in the deposit. Corundum, that is sapphire and ruby (ruby is the sister stone to sapphire), tends to work its way to the bottom of these deposits and only stops settling when it reaches bedrock, much in the manner of gold. I've had the experience on occasion to actually have to pry the gemstones out of cracks in bedrock with a screwdriver, they had wedged themselves so tightly into the fissures. Extreme care must be taken to avoid fracturing the stones.

Second in hardness to the diamond, sapphire holds its own with any gemstone for beauty. It comes in a wide range of colors from water clear (pure corundum), to almost red. Of course, when corundum gemstones are red, they are called rubies. Measuring 9 on the Mohs Scale of Hardness, although nowhere near the hardness of diamond (Mohs 10), this aluminum oxide (Al_2O_3) gets its spectrum of colors from trace elements of titanium, chromium and iron, plus other quite often unidentified elements. It's not unusual for a combination of the above elements to develop in one stone. Such is the case of ilmenite, also a corundum mineral, which has a combination of titanium, iron and oxygen, making for a rather undesirable stone with cloudy patches of irregular colors and zones. Traces of chromium cause the intense pigeon-blood red of ruby, while the much sought after cornflower blue in sapphire comes from a combination of titanium and iron. The noun sapphire is from the ancient Greek word for blue. Ruby is derived from the Latin word ruber.

Dichroism can sometimes be detected in the darker-colored corundum stones. As an example, when looking at a well-formed crystal under strong light, the top end of any given stone will be blue, while the sides appear to be green or blue-green. Asterism is quite rare if not totally nonexistent in Montana corundum.

The tabular habit of sapphire and ruby can be confusing. The stone usually crystallizes in the hexagonal system, but as an example of one of its strange forms, Yogo Gulch stones are, for the most part, shaped like a wedge, with no hexagonal shape whatsoever. Many of those found in the Missouri River also often have a boxlike shape if they are not water worn. They will also be discovered as flat hexagonal wafers, many times wider than thick. The stones recovered from the Rock Creek deposits tend to be in the form of tiny flattened barrels and triangular, boxlike shapes. Donnie and I would be washing gravel from the Missouri River deposits, so our stones would be hexagonal in shape for the most part, but rather stubby and flat.

After the walking tour of the mine complex and a visit with the owners, Donnie and I tried our hand at recovering sapphires. It was a very hot day, so we opted to buy a pail of concentrates and recover the stones rather than work in the mine proper.

The concentrates we worked with were in a 5-gallon plastic pail. We were told that with careful washing, screening and collecting, that pail would take approximately one hour to process. In the yard outside the shop are several work tables, and nearby are washtubs filled with water. I noticed that the tubs were the old claw-foot type, the kind we rarely see in bathrooms today.

If you've never processed sapphires, it works on the same principal as panning gold. Square screens are provided with a fine mesh, just large enough to let the mud and waste material pass through. A

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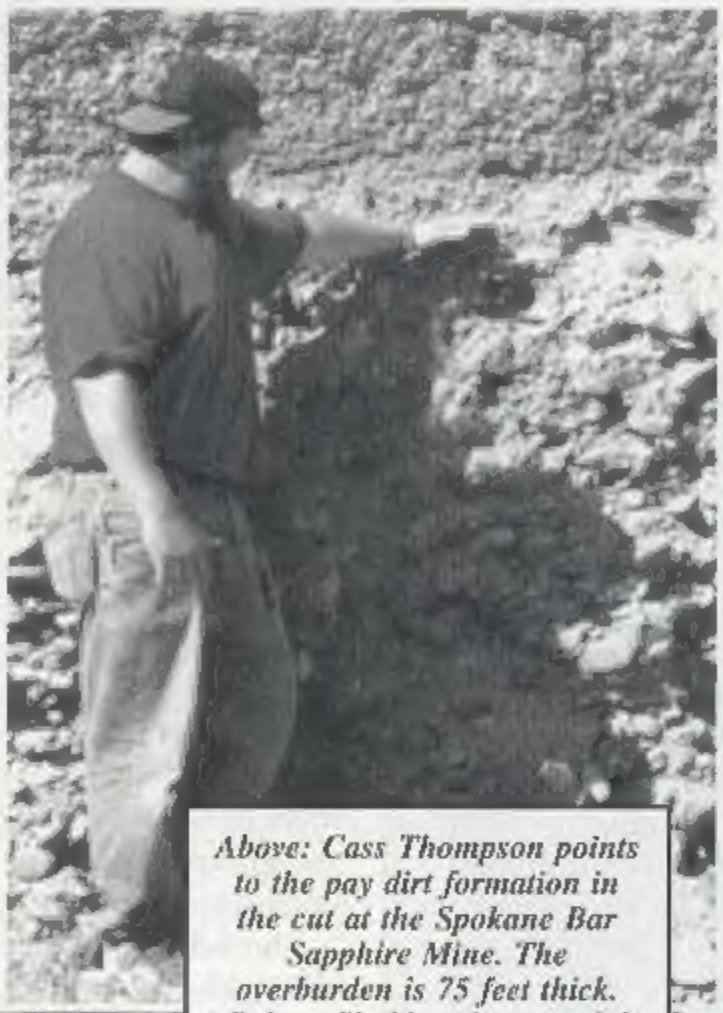
The Montana state capitol building is a nice attraction if you have the time to visit.

Maps in this guide provide general information only. The maps are not accurate in miles or in geographic distances. Consult the Montana Official Highway Map (pg. 74-75) before travel for accurate information.

generous amount of dirt is put in the screen, but not too much. I've learned from past experience that if you overload the screen, it will be most difficult to wash out the fine waste particles. The equivalent of three or four coffee cups full should be enough in a 14 by 14 inch screen. Next, immerse the screen in the water and shake it up and down several times. Turn the screen a quarter of a turn and shake again. Do this until the stones appear clean. By shaking the material in the screen, you settle the heavier material—namely sapphires, an occasional garnet, and even at times topaz—to the bottom. Lift the screen from the water, let it drain and (here's where the expertise comes in) flip the screen over and slam it down on the table all in one smooth movement. Remove the screen, you and if you did it right, the sapphires will now be resting on top of the mound of concentrates.



Above: Cass Thompson points to the pay dirt formation in the cut at the Spokane Bar Sapphire Mine. The overburden is 75 feet thick. Below: Shaking the material in the screen causes the heavy sapphires to concentrate at the bottom of the pile.

Donnie and I often found two, three or more nice stones in each screening. Many are almost clear, a few are grayish green, some are a nice green, and once in a while, a pretty blue stone appeared.

We had so much fun that day, we didn't even think about the intense heat of old Sol beating down on us. We wore sunglasses with ultraviolet protection and I wore a cap to protect my noggin. Before we began working at the tables, we did put on sunscreen. I burn rather easily, so it's a must for me.

One thing I missed was my pocketknife. I couldn't take it on the plane and I felt rather lost without it. I often use it for picking up gemstones in concentrates, using the tip of the blade. The recommended way to remove the sapphires from the washed concentrate is with a set of tweezers. The people at the shop will provide you with a pair. Care must be taken when reaching for the stones, because they have a nasty habit of slithering down through the material quicker than you can react. Of course, all is not lost, because you can place the material back in the screen, wash it, and classify it over again.

Recovering sapphires never ceases to excite me. The sight of those glistening crystals gleaming in the sunlight makes the trip all worthwhile. One way to determine whether they are actually sapphires is to set them aside and let them dry a bit in the sun. If they continue to glisten, then you are reasonably sure you have a sapphire. It also could be a topaz, another marvelous gemstone found in the same Missouri River deposits. The ordinary waste rock will most generally turn dull upon drying. One thing worth mentioning here is the fact that some of the material in those concentrates is actually a form of common corundum. It constitutes much of the sandpaper that we use in a number of woodworking projects. The material is extremely hard and durable, making for an excellent grit on the surface of the paper.

When you finish recovering your gemstones, you may have them weighed and sorted at the rock shop. You can also make arrangements to have the better ones faceted, if you so choose. This greatly enhances their value and they can be a memento of a wonderful vacation when set in a ring.

You may not realize it, but while you are at the Spokane Bar Gold Fever Rock Shop you are practically in the middle of a ghost town. Eagle Heights Addition of Leslieton, a community platted in 1913, never made the grade. Only one building stands today, once owned by a Mr. Peterson, a shoemaker. The roof shows its rafters, the wind howls through cracks in the board walls, and with each winter it slowly deteriorates from the weight of the snow. Yet, according to the record, the townsite still exists.

Donnie and I took time out to photograph the scenery. She is an excellent photographer and has a vast portfolio of photos, many of which you can see in "Montana's Gold-West Country," Montana's travel planner for 2003.

As I gazed out over the vastness of Lake Hauser, far below the mine in the distance, I thought of those 19th century pioneers and gold miners. They had come here mostly by shanks mare, often carrying what little possessions they had on their backs. Some made vast fortunes. Others, the overwhelming majority, did not, but they persevered and settled the land, making the beginnings of the great state it is today.

Donnie dropped me off at the hotel entrance and was on her way. Our plans for the next day called for an early start and a whole new adventure. I would meet other lady escorts and pay a visit to the historic town of Philipsburg, plus more exciting activities too numerous to mention here.

For More Information ...

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